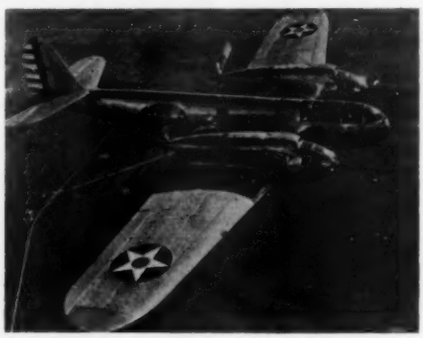
AMERICAN MACHINIST

April 19, 1939



AIR DEFENSE—*Properly equipped air bases are vital to the effective operation of the nation's air services (page 258a)*

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American Machinist

is pleased to announce that its

1939 Annual Modern Plant Number

published May 31, will be devoted to

"Industrial Mobilization"

This complete issue will climax the current American Machinist series of reports on the general defense situation (Jan. 11), arsenals (Feb. 8), Navy yards (Mar. 22) and fighting aircraft (in this issue).

Among plants and processes to be described are:

Navy Engines . . . . . General Electric Co.
Aircraft Engines . Pratt & Whitney Aircraft Div.
Diesel Engines . . . . . Fairbanks, Morse & Co.
Aircraft . . . . . Consolidated Aircraft Corp.
Anti-Aircraft Gun Mounts . York Safe & Lock Co.

Both editorial and advertising pages will repay close reading. Here will be marshaled editorially the latest metal-working processes on Army and Navy orders, and on the advertising pages equipment which will help you do similar jobs more efficiently.

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Conveyors Aid Assemblers

Floor space and human effort are conserved by Delco-Remy through the adoption of modern conveying and machine methods of assembling its automobile voltage regulator

By RUPERT LeGRAND
Detroit Editor, American Machinist

METHODS of assembling electrical devices range all the way from hunting through a pile of parts to the highly integrated system put into operation by the Delco-Remy Division of General Motors, Anderson, Ind. In the latter, most every known kind of conveyor, chute, slide, hopper and bin is applied to the problem of handling parts expeditiously and leaving the operators free for maximum productivity through a few simple hand movements.

Thus, in a department measuring 120x150 ft., approximately 275 girl operators and 50 inspectors assemble the staggering total of 21,000 voltage regulators, horn relays and miscellaneous relays in an eight-hour day. The voltage regulator alone, which is produced at the rate of 1,000 per hour by about 65 per cent of the working force, comprises about 65 parts and requires almost that number of different assembly operations.

Voltage-regulator assembly lines are typical of the departmental layout. Two U-shaped sub-assembly lines produce the relay coil and the regulator coil respectively. At the discharge ends, work from these lines is transferred to a long block-type assembly conveyor running at right angles. Here the baseplate is added. After soldering and staking operations, the finished regulators are removed and sent down final conveyorized assembly lines paralleling the original sub-assembly lines. Here they are given a number of tests and adjustments before transfer to the inspection department via a specially equipped chain conveyor.

Relay coils and regulator coils start

1. Twisting Fragile Leads Together

To protect a fragile enameled-wire, shunt-coil lead, and to make soldering to a terminal easier, the lead is twisted with a short length of extra-flexible wire cable. Such an operation is extremely tedious by hand and the results are mediocre. Here the operator holds the two strands against a friction-driven spindle with a small hook in the end. The shunt coil is neatly wrapped around the cable in the twinkling of an eye.

out pretty much alike on their respective sub-assembly lines. Coil winders are tied in directly with the progressive sub-assembly of the two coils. These coils are wound eleven at a time, and each machine produces about 300 per hour.

Inside each U-shaped sub-assembly line, there is a pallet conveyor carrying small tote boxes of parts. Thus, assemblers at the many stations always are served with parts without necessity for getting up and leaving the line. The tote boxes are kept filled by a male attendant who works between the pallet conveyors and the storeroom across the aisle from the assembly department. Female operators reach to the pallet conveyor for a supply of parts with which to build up the sub-assemblies that they are setting up in block conveyors or in the dials of hydraulic assembling presses. Accompanying illustrations show some of the highlights in equipment and methods.

2. Special Block-Type Conveyor

Typical of the concentration of relay-coil assembly operations is this chain conveyor fitted with specially made Bakelite blocks. Recesses in the blocks provide for correct and easy positioning of the coil and hinge post while making this important sub-assembly. The hinge post is placed first and then the coil is slipped over it. At the other end of the short conveyor, the next operator removes the assembly, places a fiber washer on top of the coil and stakes the hinge post on a hydraulic dial-feed press. The pallet conveyor carrying tote boxes of parts is shown at the upper right.

3. Tandem Staking Presses

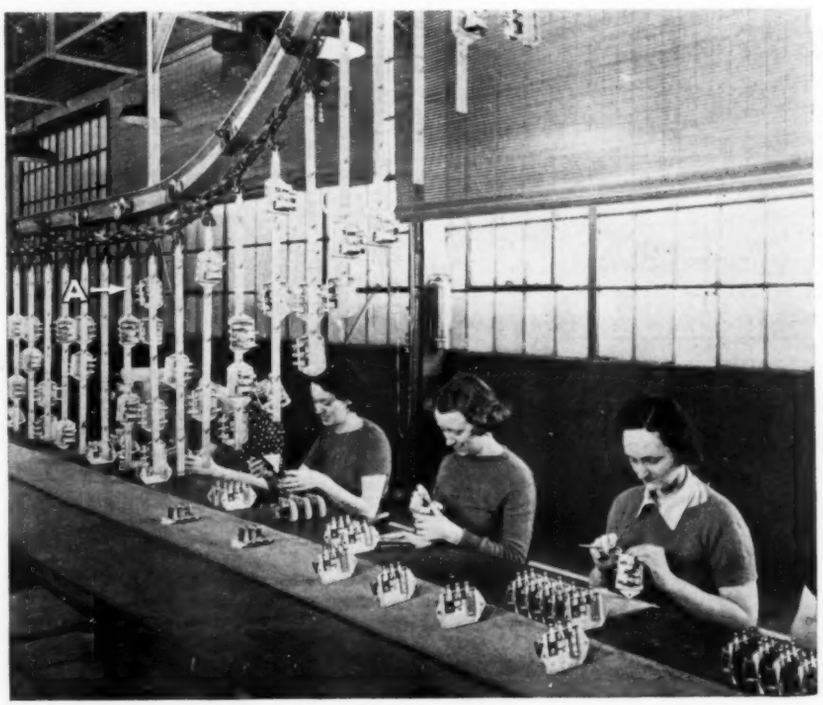
Near the end of the assembly line for the voltage regulator coil, there are two hydraulic assembling presses fitted with standardized 14-station dial feeds. The first machine presses a fiber retaining washer over the core. As the dial comes around to the unloading station, a spring pushes the first assembly out of the dial sufficiently for it to engage with a track or chute that conveys it to the next machine. Pressure of the succeeding parts forces the piece to fall down the inclined track. At the second machine, an operator slips the coil and a second fiber retaining washer over the core, and loads the loose assembly into the dial for staking.

4. Soldering Baseplate Connections

Three leads must be soldered to connections on the baseplate. Two spots are done by one operator and the third by a second operator, because the third spot is much larger and requires more heat. Three irons are kept in use by two girls, one standby iron being heated and used by either operator as her iron gets cold. The irons are fitted with 400-watt elements to handle the heating load. Points are changed eight to ten times per day, and are held in a setscrew holder to facilitate removal for dressing. Approximately 1,000 baseplates are handled per hour on this line. A centralized exhaust system removes fumes from soldering.

5. Busy Conveyor Junctions

Two U-shaped assembly lines produce the relay coils and the voltage regulator coils respectively, and both lines discharge to a block-type conveyor traveling at right angles. At these two junction points, operators place the coils on conveyor blocks made especially to receive one of each in the correct positions. The conveyor blocks move on to the end of the loop, where another operator places sub-assembled baseplates on top of the coils. These loose assemblies then double back in the foreground for final staking and soldering operations.



6. Conveyor Storage and Selection System

Chain conveyor, which loops around the assembly department and descends to serve several stations, carries many thousands of assembled voltage regulators in various stages of inspection. The parts are suspended on five double pairs of hooks, each pair having a definite function. If it were not for these hangers, the assembly department would have to be stretched out to many times its present length. As it is, the great concentration of regulators is brought again and again to the operators, who after performing their work, place the regulators on the next station of hooks. Thus, the pieces finally pass through all steps and are removed from the conveyor for shipping. Classifications of work in process, as denoted by five pairs of hooks, are: top pair—rejects from final inspection to be removed by special repair men; second and third pairs—for regulators leaving assembly for inspection, where they get an operating test at room temperature and another at 150 F., fourth and fifth pairs at bottom—for parts leaving the ovens where they got the hot test, and are cooling prior for the final cold test and packing. A glance at the conveyor tells the foreman a great deal about how his department is operating.

Determination of Shop Load

Bottle-necks, which frequently develop in the machining sections when a shop is making many different products, may be prevented by records of machine loads

By D. J. HUCKA
Generator Works Department
Westinghouse Electric and Manufacturing Company

WE HAVE developed a method by which we can know the approximate load ahead of each machine in each of the various machining sections. In this way, we are able to locate the bottle-necks in the machining sections before they appear and make plans to eliminate them. We also date new business in line with the load ahead. This information is useful to the section supervisors in planning ahead as to the number of people and shifts required to do the work. This is true in periods of low activity as well as during times of maximum load.

As soon as the drawings are completed. manufacturing information is prepared and sent to the shop, where it is kept until the work is done. This information includes all the paper work that is required by the various shop sections. It includes requisitions to order material either from the outside or from a storeroom, requisitions to machine individual parts and to assemble them after machining.

This information is passed from the information clerk to the schedule clerk, who adds the date to each requisition when the material or labor as covered by that requisition is to be completed. Next the information passes to the time study department where the list of operations required, with the time value for each, is added. After the time values have been added, the information is complete and is ready to be duplicated and distributed. Copies are made as required for the production, time study and cost departments. Each original requisition is duplicated with a time card for each operation listed. The card for each succeeding operation is marked with a number corresponding to the operation covered by that card. A column on the requisi-

ORDER NO. Sample | G. O. ITEM | ASSIGNED ITEM 100 A | REQ. FOR SECTION B1 | DEL. TO SECTION B3 | DATE WANTED 6/16 | DWG. & SUB. OR STYLE NO. 00-A-000 | ITEM

QUANTITY 1 | DWG. AND SUB. 00-A-000 | ITEM 1 | STYLE OR PATTERN | DATE PROMISED

NAME OF PIECE Frame | PROC. OR FINISH

MATERIAL FOR ONE PIECE

NOTES: TAKE MATERIAL FROM MP1 6/7 AND MACHINE 6

CUSTOMER | CUSTOMER'S ORDER

PROD. CLERK | WRITTEN BY | SECTION 2N | DATE 5/13 | TIME | ORDER SERVICE REP.

WORKMAN'S NAME | SECTION | GROUP NO. | CHECK | DATE

MATERIAL REQ'D FOR ORDER
P. D. SPEC. | NET AREA
RATIO | NET WT. EACH
MATL. PRICE | SCRAP CREDIT
MATL. COST
LABOR & O.H. COST
FACTORY COST EA. LB.
COST DEPT. NOTES
DRG. & SUB. OR STYLE NO. | ITEM

OPER. NO.	TOOL NO.	MANUFACTURING OPERATION	SECTION	GROUP OR CK. NO.	PIECES APPROVED	STANDARD TIME SET-UP	STANDARD TIME RUN. TIME	STD. COST RATE	INSPECTOR'S SIGNATURE
1	30258	Bore & face					18.00		
2	4058	Plane base					9.00		
3	Hand	Layout base & ends					4.50		
4	41299	Drill base				0.46	1.00		
5	41299	Drill & tap ends				0.25	5.25		
6	2990	Cut slots				1.25	10.00		
7	Hand	File burrs & clean					1.25		
		Allowed hours represented by this operation					11.25		

Copies are made of each requisition for each operation required. This copy is for Operation No. 6 and should be filed in the control box behind the spacer for machine No. 2990

ALLOWED HOURS LOADING

SECTION B-1 Cost Center: 112–113 Dispatcher: West. Date: 6–4–38.

CAPACITY Allowed hrs/wk Eff. 110%

Group or Mach.	Operation	Date	Up to 6/4	6/5 to 6/11	6/12 to 6/18	6/19 to 6/25	6/26 to 7/2	7/3 to 7/9	7/10 to 7/16	7/17 to 7/23	7/24 to 7/30	7/31 to 8/6	8/7 to 8/13	8/14 to 8/20	8/21 to 8/27	8/28 up	Total	Present shifts	2 shifts	3 shifts
1	Boring Mill, 16 ft		80	210	160	130	160	170	300	150	130	180	90	60	110	300	2230	176	176	264
2	Boring Mill, 14 ft		...	40	110	120	70	110	80	50	70	...	20	40	...	110	820	88	88	132
3	Boring Mill, 10 ft		20	80	80	120	40	110	45	95	110	...	...	20	10	160	890	88	88	132
4	Boring Mill, 6 ft		50	60	80	45	80	120	80	30	60	20	...	10	...	90	725	44	88	132
5	Planer, 14 ft		110	60	30	20	50	40	30	45	35	20	...	...	...	20	460	44	88	132
6	Planer, 10 ft		30	40	30	25	15	45	30	20	...	...	10	15	...	...	260	44	88	132
7	Planer, 6 ft		...	10	110	40	30	45	30	15	10	...	...	...	10	45	345	88	88	132
8	Dovetail Mill		...	...	...	...	...	...	...	...	...	...	...	...	...	...	0	44	88	132
9	50° Dia. Grinder		...	...	...	...	...	...	...	...	...	...	...	...	...	...	0	44	88	132
10	Post Mill		...	40	135	105	65	90	...	...	65	80	40	...	...	90	710	88	176	264
11	Drilling Machine		...	20	50	20	10	...	...	...	...	...	40	...	...	30	170	44	88	132
12	Radial Drill Press		240	200	360	180	150	220	100	60	80	40	...	...	...	690	2320	220	264	396
13	Keyseater		...	20	35	10	25	...	...	...	...	20	...	...	...	95	205	44	88	132
14	Layout		75	60	85	40	35	50	20	10	15	10	...	...	...	40	440	88	...	...
15	Helpers & Chippers		110	75	55	70	60	50	40	20	30	10	15	20	10	75	640	88	...	...
	Total		715	915	1320	925	790	1050	...	...	...	...	...	...	...	...	10215	1232	...	...

The above allowed hours include 20 per cent allowance for extra work.

Load charts, made up at frequent intervals for use by work dispatchers and supervisors, aid in maintaining proper control over the work going through the department. These charts should be made up with sufficient frequency so that work will not come into the section and be shipped out between chart dates

tion gives the number of the shop machine tool that is to do the work. In cases where there are several machines that may do the same work, we list the type of machine instead of the actual number.

Time cards are separated and filed in order of date wanted in a box indexed for the operation shown on the card. There is a separate file for each work group, machine or group of machines. In a machining section you might have a separate file for radial drill press, 60 and 72 in. vertical boring mills, 10 ft. vertical boring mills, turret lathes, engine lathes, welder, chip and file, and other necessary operations. Each spacer has a tab upon which is written the machine number or group number. Only machines that can do the same work are grouped together. After the time slips have been sorted by machines, we have a complete file of the work ahead of each machine in the order of date wanted.

In the lower right-hand corner of each time card is placed the total time represented by the operation shown on that card. This time is the number of pieces called for on the order multiplied by the allowed time per piece, plus the setup time. In order to determine the actual load ahead, it is necessary only to add up the time values on the cards in file. It is desirable to add the hours ahead of each machine for each week in the future. This can very easily be done each week or two as desired. The time between loading charts will depend upon the type of work being done; that is, whether the dates are long or short. If the turn-over is rapid, it will be necessary to make the loading charts more often. The charts should be made often enough that work will not come into the section and be shipped out between the times that charts are made.

After the allowed hours ahead have been added for each machine, the information is placed on a chart such as shown. In the example section the time cards are divided into 15 groups, and this chart represents conditions in the section as of June 4, 1938. The first column, marked "Up to 6/4" shows the hours that are overdue; these represent work that should have been completed prior to 6/4. The hours in the column marked 6/4 to 6/11 represent the hours ahead of each machine for that week and so on across the sheet. The allowed hours on the chart are allowed hours actually in file plus a percentage to cover the unforeseen operations, repairing defective work and other lost time that can be expected. The percentage to be added is obtained from the past history of the section. In this particular case we added 20 per cent.

In order to use this chart properly, it must show the actual capacity in allowed hours for each group. We found it convenient to show three capacities on the chart. First, present shifts, which is the allowed hours for work that could be done with each man on the payroll working full time. These men may be working on first, second or third shifts. From the example it can be seen that some machines are working one shift while others are running two or three shifts. Second, the capacity with each machine operated two full shifts. Third, with all of the machines operating three shifts or 24 hours per day each. In this way it is possible to tell at a glance just how the various machines are loaded and to determine when it is necessary to add or take off a shift.

Since time values are in allowed hours and not elapsed hours, it is necessary to consider the efficiency of the section or machines in determining the capacity. With an efficiency of 110 per cent, a workman will perform 44 allowed hours of work in 40 elapsed hours.

This information also is valuable to the supervisors in planning work ahead. It shows how many people will be required to do the work and will show when it is necessary to add or take off shifts. In a factory where the budget is set up to vary with the shop load or productive hours, the supervisors may determine what per cent of capacity to expect for the next few weeks, and thus be able to exercise better control over budget expenditures.

Also, this information is helpful in determining the need for additional machines or, in some cases, may show an over capacity. When this is the case, it may be possible to move machines to other sections.

Rubber Mountings for Industrial Equipment

One way to reduce vibration is to absorb it, and here is where proper materials and mountings come into play

By WALTER C. KEYS
Mechanical Product Engineer
United States Rubber Company

RUBBER is the partner of mechanism. The phenomenal reduction of vibration and noise in America's most personal piece of machinery—the automobile—has taught that crudeness in mechanism is no longer necessary. Methods used in the automobile are applicable to all kinds of light and heavy industrial equipment.

Vibration of mechanism can be reduced by one or more of the following treatments:

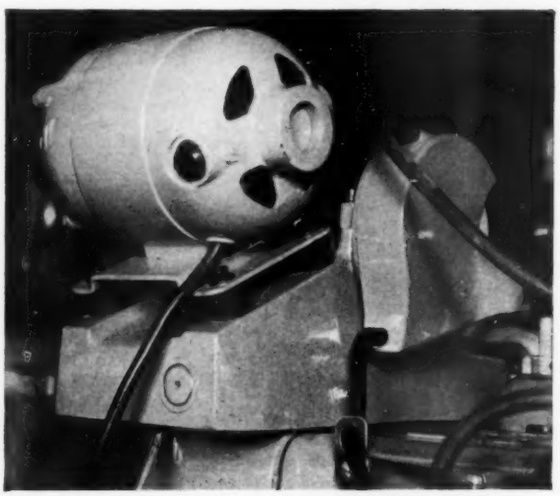
1. By supporting on resilient mountings of proper flexibility to absorb the vibration instead of transmitting it;
2. By rigidly securing to a very heavy foundation;
3. By the use of counter-vibrators whose natural frequency is equal to the forced frequency of the mechanism.

Resilient mountings made of rubber are most extensively used for the reason that they not only absorb the vibration, but they also insulate against noise which is readily "telegraphed" through steel springs which could often be made to absorb vibration adequately.

The absorption of vibration is simply demonstrated by supporting a weight on a rubber band, the upper end of which is held in the hand. Select a weight whose *natural* frequency of vibration is quite low. If the hand is now moved up and down at a rate which is several times faster than the natural vibration of the weight, the latter will practically remain still although it is supported by the rapidly moving hand. Application of this treatment is used to absorb vibrations of many kinds including the production of good riding qualities in vehicles.

If the hand is moved at or near the natural frequency of the weight on the rubber band, the weight will then move through a large amplitude. This illustrates the fact that improperly chosen mountings may be much worse than no mountings at all.

If natural frequency is a tenth of forced frequency the absorption will be 99 per cent; if a quarter, it will be 93 per cent; if two-fifths, it will be 81 per cent; etc.

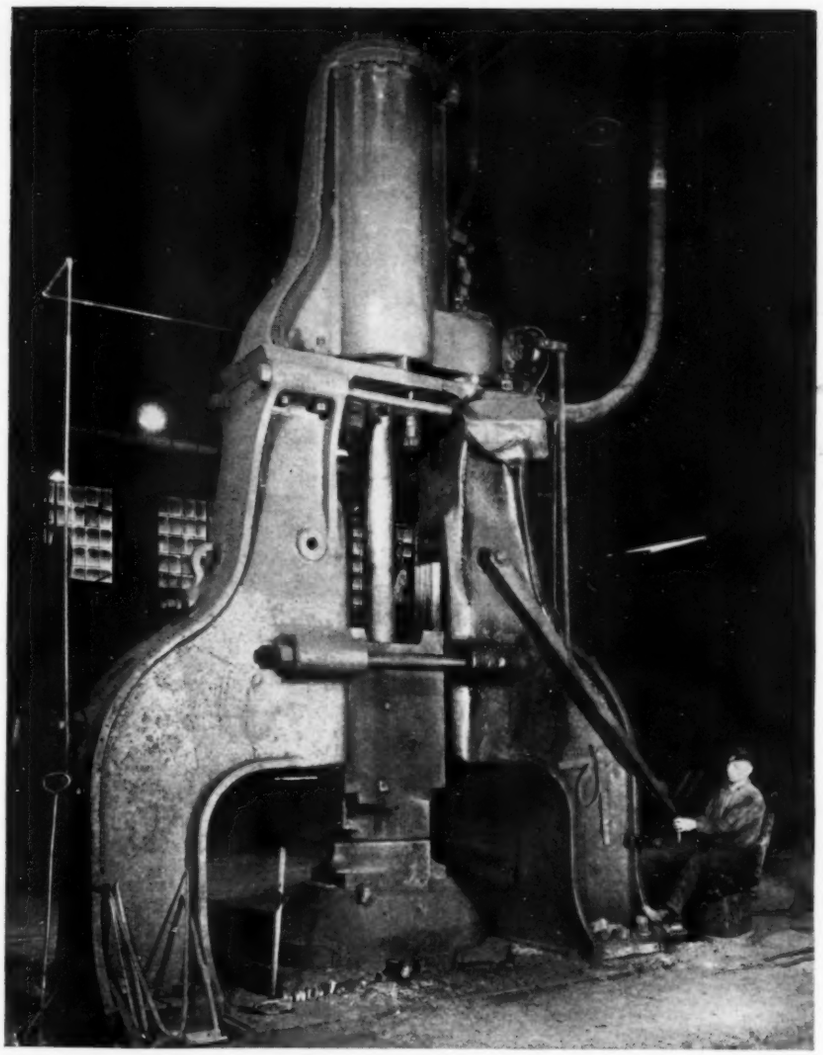


Rubber mountings are shown here used under a motor to overcome vibration which would otherwise be transmitted to the bed of this machine tool

If a short portion of the rubber band supports the weight, the deflection (or elongation of the band) will be small, and the natural frequency will be high; if a longer portion of the band supports the weight the deflection will be larger and the natural frequency will be lower. Natural frequency, therefore, is determined by static deflection, and since for insulation of given effectiveness there is a relationship between natural frequency of a mechanism on its mountings and the forced frequency to be insulated, it is a simple matter to determine the static deflection required of the supporting mountings.

If natural frequencies are low, the corresponding static deflections are large. The first requirement of vibration-absorbing mountings is, therefore, deflection and carrying capacity. Rubber in mountings can be most efficiently utilized if it is stressed either in shear or compression. In general, the capacity is larger and the safe deflection smaller if rubber is stressed in compression than if stressed in shear.

Rubber is practically as non-compressible as water. Hence if rubber yields under a compressive load, it must be able to bulge at right angles to the direction of that load. Obviously the bulge area of thin slabs is very much less than that of thick slabs, and the ratio between load carrying area, and bulge area (known as the "area ratio") then offers a means of calculating the deflections of



The anvil of this steam hammer rests on a rubber-mounted foundation block to reduce transmission of the blows to adjacent buildings and equipment

slabs of known dimensions and physical properties providing reliable data are available.

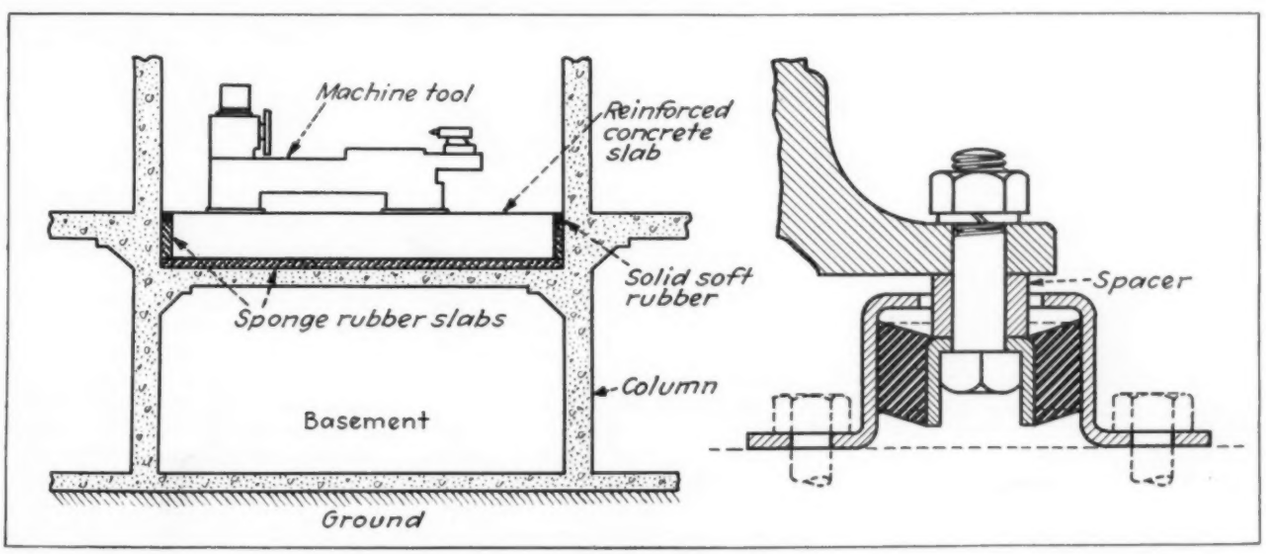
The shear modulus of a given rubber compound is that force which will cause a deflection in shear of 1in. in a 1 in. cube of the material. It is the "rate per inch" as a spring, per square inch of one shear face, per 1 in. of thickness.

Almost all shear mountings are "sandwiches" comprising rubber bonded to and between steel plates. The best bond known is obtained by carefully cleaning the metal members and plating them with brass of an exact analysis, after which they are placed in contact with suitable rubber compounds. The assembly is then confined within a cavity in a steel mold, subjected to high pressure and to a temperature of about 300 F.

Life of Mountings

Like any other commodity, the life of rubber mountings depends entirely upon the abuse to which they may be subjected. When used under favorable conditions, mountings may be expected to be in good condition at the end of at least six years.

The use of rubber mountings is governed by economics. If machinery has not changed, fundamentally, people have changed. They demand less vibration and shock, lower noise levels and better appearance. Moreover, it is frequently less costly to install adequate rubber mountings to effect insulation than it is to strengthen buildings, increase the strength of structural members, install heavier foundations or to change location.



Shock and vibration in building construction may be absorbed by the use of structural sponge rubber under a concrete slab which forms the machine's foundation. A mounting that has wide application uses a channel on the foundation and spacers on the machine base which pass through the channel without touching it. In this arrangement the machine is held even though an overload causes the rubber to fail, a desirable safety precaution

MANUFACTURING LAYOUT AND TOOL ESTIMATE

MODEL	PART NO.	PART NAME	SUB-ASSEMBLY NO.	
AA	20277	SHIFT LEVER	20280	January 10, 1938

OPER. NO.	OPERATION OR INSTRUCTIONS	MACHINE	TOOLS	CLASS	ESTIMATED TOOL COST	ACTUAL TOOL COST
1	Pierce and blank	Punch Press	Prog. Pierce & Blank Die	A	145.00	
2	Form	Punch Press	Form Die	A	90.00	
3	Mill	Hand Milling Machine	Milling Fixture	A	47.00	
4	Wash and dry	Degreaser	No tools	-	-----	
5	Harden	Cyanide Furnace	Special Hardening Rack	C	15.00	
6	Cadmium plate	-----	No tools	-	-----	

LAYOUT | ESTIMATED BY | CHECKED | PRELIMINARY APPROVAL | FINAL APPROVAL

1

Aids for the Tool Engineer

Each activity of the tool division must be properly correlated for efficient control of tool costs— several useful forms are suggested

By WALTER KASSEBOHM
Superintendent of Tool Division
Marchant Calculating Machine Company

FOR MANY YEARS the tool-making department was considered by industrial executives as an unavoidable burden and usually was shown in the general factory accounting statement as "expense." Dies, jigs, fixtures and other tools were devised and built complete by the toolmaker, with the help of the toolroom foreman, who also had the responsibility of keeping all machine tool equipment and cutting tools in running shape. Stampings usually were made in fairly primitive dies, as compared with our present-day tools, and they frequently were finished by hand or with cheaply made tools which were difficult to handle and seldom economical.

Recent years have seen great strides in the development of mass manufacturing methods, with accuracy and efficiency becoming of increasing importance, and an efficient tool organization is one of the essentials for producing the desired results. Tool making always will carry an individual character, to which the principles of mass production can be applied only in a limited sense and, for that reason, a thorough practical knowledge of the theories and practice of modern tool making is a necessary requisite for members of the tool department's personnel.

For reasons of control and accounting, the tool division of a manufacturing plant usually is divided into such departments as: (1) tool planning, (2) tool design, (3) tool making, and (4) tool maintenance and repair. Each of these departments has supervisors operating under an exact delegation of authority. The foremen are responsible to the tool engineer or superintendent of the tool division, who must have a thorough theoretical, as well as practical knowledge of modern tool designing, tool making, machine tools, production equipment, accounting, statistical methods, budgeting and, last but not least, an understanding of human relations.

One of the principal activities of the tool planning department is the es-

Fig. 1—The manufacturing layout and tool estimate sheet is prepared for each new or changed part upon receipt of drawings. This sheet serves as a master routing sheet from which detailed factory routing sheets are prepared once the layout has been approved

Fig. 2—A record of the tools made for each part is essential in the proper operation of a tool-planning department. This record should show the complete history of the tool

Fig. 3—Where a production record of each tool is maintained by the tool-planning department it is easy to judge when a new tool should be made, or when a different type of tool is required because of increased production runs

Fig. 4—Standard data sheets, which can include instructions to workmen and records of allowable tolerances and clearances are of major importance in operating a tool-making department efficiently

tablishment of "Manufacturing Layout and Tool Estimate Sheets," such as that shown in Fig. 1, for new parts after the engineering department has released drawings. These sheets show the sequence of manufacturing operations, the machine equipment to be used for each operation, and all tools required to produce the part. Each tool is classified with a standard symbol, such as *A, B* or *C,* according to an established classification related to the quantities of parts that the tool will be expected to produce and the corresponding type of tool construction. The estimated tool cost also is recorded. Rough sketches of new tools or of necessary alterations to existing tools, if such are to be used, as well as instruction sheets, are made and attached to the manufacturing layout sheet for the guidance of the tool design department once the manufacturing layout has been approved by the tool division and the production manager. These manufacturing layout and tool estimate sheets serve also as a master routing sheet.

A thorough analysis of engineering drawings must be made when preparing the manufacturing layout and tool estimate sheet. Any recommended changes in part design, which will simplify tooling or production problems, must be taken up with the engineering department so that changes can be made before the part finally is tooled.

Upon receiving final approval of

2

PLANNING DEPT. RECORD		PART NAME: SHIFT LEVER					QUAN. PER MACH. 2		PART NO. 20277	
ORDER NO.	SERIAL OR TOOL NO.	OP. NO.	TYPE OF TOOL	DATE ORD.	DATE REL'SD	DATE COMP.	EST. COST	ACT. COST	ACCT. NO.	REMARKS	DWG. SIZE
857	4023-D	1	Make one Prog. Pierce & Blank Die.	Jan. 11 1938	Jan. 16 1938	Feb. 7 1938	158.00	163.50	87	"A" class die	C
858	4024-D	2	Make one Form Die.	Jan. 11 1938	Jan. 14 1938	Feb. 1 1938	95.00	91.30	87	"A" class die	C
859	4025-F	3	Make one Milling Fixture.	Jan. 11 1938	Jan. 20 1938	Feb. 8 1938	42.00	45.70	87	"A" class fixt.	C
860	4026-M	5	Make one Hardening Rack.	Jan. 11 1938	Jan. 20 1938	Feb. 1 1938	18.00	19.00	85	"C" class fixt.	C
941	4023-D	-	Replace broken punch in Prog. Pierce & B. Die.	July 17 1938	July 17 1938	July 18 1938	4.00	5.10	80	Operator missed progression.	-
972	4024-D	-	Add automatic knock-out to Form Die	July 21 1938	July 21 1938	July 24 1938	13.00	11.70	87	For easier operation of die	-

3

PRODUCTION RECORD OF TOOL — TOOL No. 4023-D

DATE	PART NO.	OPERATOR	QUANTITY SCHEDULE	QUANTITY ACTUAL	TOOL CONDITION	O.K.'D BY
2-10-38	20277	Jones #878	8000	8215	Prog. Pierce & Blank Die O.K. Sent to tool vault.	J.Q.
5-2-38	20277	Staves #952	6000	6117	Prog. Pierce & Blank Die O.K. Sent to tool vault.	J.Q.
7-16-38	20277	Jones #878	8000	1348	Broken punch. Misoperated. Sent to tool room for repair.	J.Q.
7-18-38	20277	Jones #878	6652	6870	Die was ground after this run to prevent burr on part. Sent to tool vault.	J.Q.

4

Issue #29

MARCHANT TOOL NOTES

Issued by Walter Kassebohm

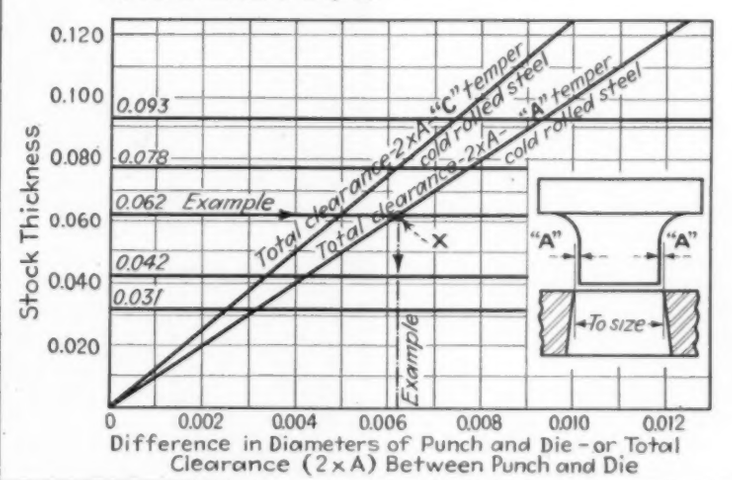
July 19, 1937

CLEARANCE BETWEEN PUNCH AND DIE BLOCK FOR BLANKING OPERATIONS

In order to have a clean fracture on a blank, a minimum pressure when operating the blanking die and the least amount of a burr, the clearance between the punch and die block should be of a certain dimension. As mentioned in Tool Notes, Issue #1, the clearance between punch and die block depends on the thickness and on the hardness or ductility of the stock to be blanked. The blanking pressure reduces as the clearance between punch and die block increases but at the same time the bowing of the part becomes more prominent and a burr will appear on the blank when the clearance is too large. Secondary shearing, which means a jagged and splinter-like fractured edge of the blank is an indication of too small a clearance. It is, therefore, evident that a correct clearance between punch and die block is of great importance.

We are mostly using "A" temper and "C" temper stock. "A" temper stock, which has a Rockwell "B" scale of approximately 95 to 100, is hard and not to be formed. "C" temper stock, which has a Rockwell "B" scale of approximately 65 to 70, is soft and can be formed without showing cracks.

Below is a chart showing the total clearance between punch and die block which is to be applied to blanking punches only. The dotted line on the chart shows the following example: Stock thickness 0.062", "A" temper. The 0.062" thickness line intersects the "A" temper line at "X". The projection of point "X" shows a total clearance of 0.0062" or 0.003" for the "A" dimension, as shown on sketch. This dimension can be checked in the die with a shim or feeler on each side of the punch.



the manufacturing layout, written orders are issued for tools that must be designed and built, or altered. Where the part under consideration is a change in design of a previously made part, the engineering changes must be checked for necessary tool alterations and orders prepared for the work necessary in making the changes. When this is done, requirements of old-style parts for service must be considered and, in many cases, the tools must be arranged so that old-style parts also can be made.

No tool-control system worthy of the name is complete without a means for recording and keeping up to date a list of all tools used to manufacture a given part. Such a record card is shown in Fig. 2. A separate card is kept for each part so that each tool required for a given part can be located quickly. The cost for new tools, as well as for repairs or alterations, is recorded and the classification of the account number gives an explanation as to the reason for any work done on the tool.

Another form that is particularly useful in the operation of a tool planning department is a "Complaint" form on which difficulties encountered when using a tool can be explained. This form also can be used to explain repair requirements. A copy of the complaint should be returned to the originating department to show the disposition of the complaint or the number of the order issued to overcome the trouble.

Fig. 3 shows a "Production Record" card which is kept up to date for each numbered tool in the plant. This card gives a complete history of the number of parts made in the tool and, it is to be noted, records the condition of the tool at the end of each run. Information for keeping these records is taken from a tool release ticket which is attached to the tool by the inspection department at the completion of each run. Both the production department supervisor and the time study man in the shop note on the tool release ticket any pertinent remarks regarding the condition of the tool or recommendations for its improvement.

Among the other duties of the planning department is the keeping of a constant check on small tool requirements and the issuing of purchase requisitions when additional tools are required. This includes the issuance of purchase requisitions for equipment and tools to be made by an outside company according to designs prepared in the tool design department. All orders issued for making new tools, or repairing or altering old tools, should be estimated before the work is done and the record kept to compare the estimated with the actual tool cost. These records given an immediate check on the performance of the tool estimators, tool makers, and tool room supervisors.

There exists today, in the tool design department, a major opportunity to develop standards for unit parts for dies, jigs and fixtures. The individual character of most tools permits only slow progress in this respect, but a systematic check of requirements in the particular tooling problems of a given company will reveal that even "company made" standards for small tools, tool unit parts and toolroom instruction sheets can be of great value.

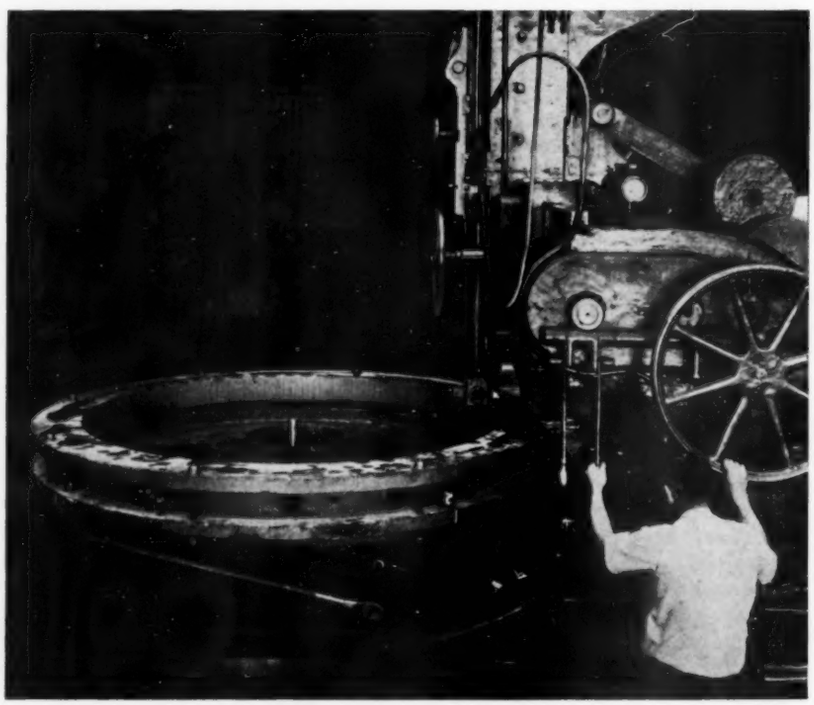
The toolroom preferably is divided into several units, as, for instance: (1) new tool-making and major repair division, (2) tool-maintenance and minor repair division, including die grinding and tool sharpening, (3) special machine division, including such operations as jig boring, die profiling and form sawing, and (4) the grinder division in which cylindrical and special form grinding operations are performed. Tool making covers a wide field and, since toolmakers usually have had a varied experience, it is advisable to issue instruction sheets which show acceptable standards. Sheets such as that shown in Fig. 4 can be used as reference sheets. Too frequently such data are not available and many dimensions are left to the rule-of-thumb calculations of the individual toolmaker with resulting wide variations in the quality of tools produced.

The machine repair department is responsible for the repair, alteration or overhauling of machine tools and production equipment. The establishment of a "preventive maintenance" program is to be recommended, since a periodic check will reduce production delays through the early elimination of inaccuracies and worn parts. A machine tool and equipment record should be kept for each machine, since it will show the upkeep cost, alterations and additions, and is valuable when establishing replacement policies.

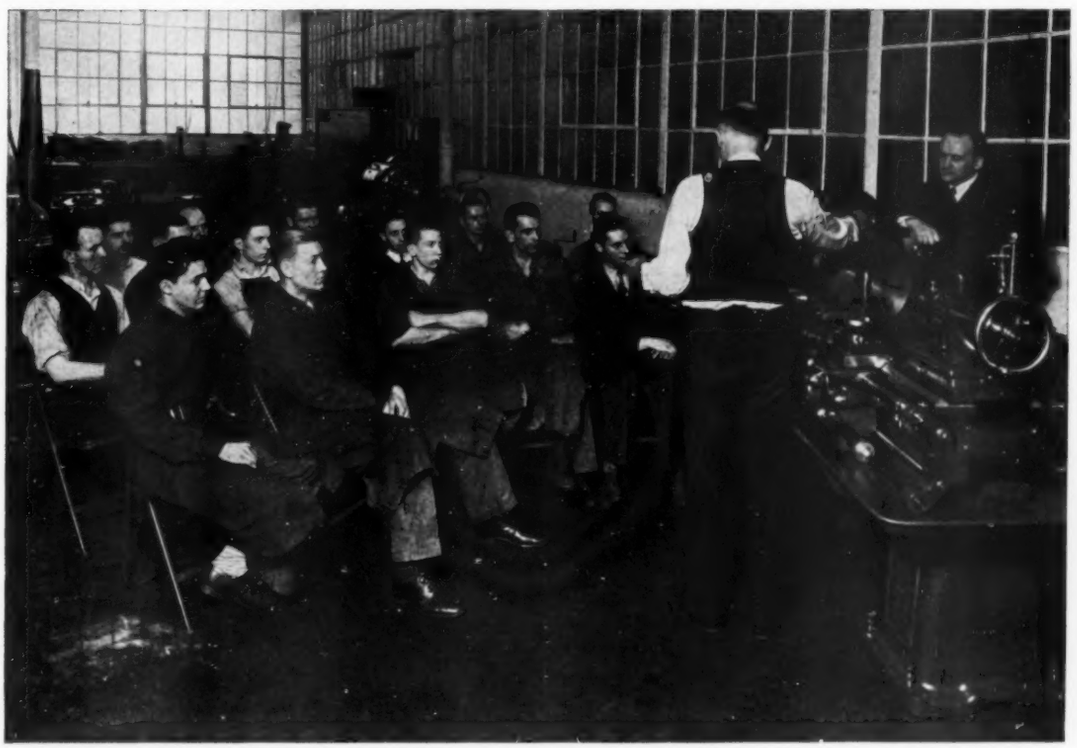
Boring Job on a Slotter

Having a large boring job and no boring mill that would swing it, the method shown herewith was used. The casting is part of the rotating mechanism of a large steam shovel. The method was to put the ring on a revolving table mounted on the floor plate of a large slotter and to support the outer edge against the tool thrust.

With the casting fastened in position, the center is machined with a slotting tool as shown. The work is turned by the ratchet wrench seen at the front. This operates a worm in a worm wheel that turns the table carrying the work.



Training for Results



Class sessions, including lectures and demonstrations, are combined with continued practice on production operations in the shop to provide a well-rounded training course for trades apprentices

Flexible apprentice and foremanship training schedules include training in how to study and how to get along with people; both shop and laboratory work are covered

By D. H. McKELLAR
Director of Training, Monarch Machine Tool Company

SURVEYS of employable adult labor reveal a constant shortage of skilled workers. Leading tool builders, concerned about the future of their product and anxious to perpetuate their crafts, have been carefully developing employee training programs. In keeping with this trend, the Monarch Machine Tool Company's training school gradually has been evolving for several years and now is being crystallized into a well-rounded program.

This program has two main divisions—trades training, and a foremanship training course. The aim of the trade course may be summarized as the training of efficient mechanics who will take pride in the performance of their work and who will have such knowledge and skill as will enable them to meet intelligently whatever demands their work may put on them. On the other hand, the objective in the foremanship course is rather one of re-education in the principles of modern scientific management.

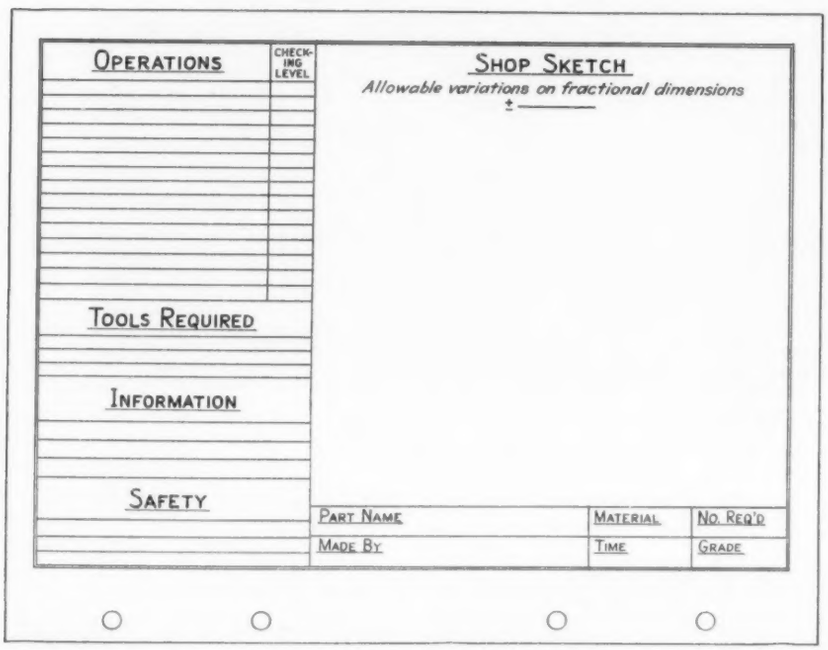
In view of the wide variation in the previous education of the student body, ranging from grade school to college, a flexible schedule for individual instruction has been adopted. Following this plan, and recognizing the fact that dislike of and failure in many school subjects is due to not knowing how to attack such studies, the course includes a unit on "How to Study Effectively" by G. M. Whipple. This includes lesson sheets, work sheets and test sheets developed to suit our needs.

The aim of this part of the course is threefold. It is to explain the principles of study; to give practice with the tools of successful study, and to learn how to organize new information into a usable form. Beginning with the study of words, their relation to ideas, simple methods of enriching vocabularies, and the develop-

ment of dictionary-work habits, the unit moves on to the efficient use of books. This includes the purpose of the table of contents, the economy and technique of using the index provided in the books used and an understanding of the symbols of annotation. Practice is given in reading rapidly and efficiently, in applying what is learned, in methods of memorizing new information and in the writing of abstract reports.

The unit method of instruction is used in the trade training division. Each unit is a representative job and the essential theory and practice concerning it is outlined on its assignment. This includes job sheets, information sheets, and test sheets. One advantage of the lesson sheet method is its adaptability to the varying needs of the men, some of whom are long in practice and short in theory. The student may stay and secure successive increments in a well organized curriculum designed to give the maximum in trade skill, attitudes and ideals of the tool trade. Short units of instruction combining the best information that has been found and practiced in the construction of lathes in the Monarch shop are studied in lesson sheet form. All trade students are employed on the job and attend the training school on their own time.

In endeavoring to teach a trade, we follow three main steps: (1) tell how to do it, (2) tell how it is done, and (3) check the student to see that he understands. All theory is taught by the development method. For example, in teaching how to plan a job a drawing of the job is projected on a screen and each student is given an assignment sheet similar to that shown. The group, guided by the instructor, then develops the proper sequence of operations necessary to complete the work, lists the tools required and notes any additional information needed for proper performance of the work. Safety factors are discussed and a time estimate is given for the job. A student then demonstrates the job from this sheet and the group studies the technique for possible improvement. A different assignment sheet is used where the matter to be studied is purely theoretical, as in a discussion of heat treating and of the qualities of steels.

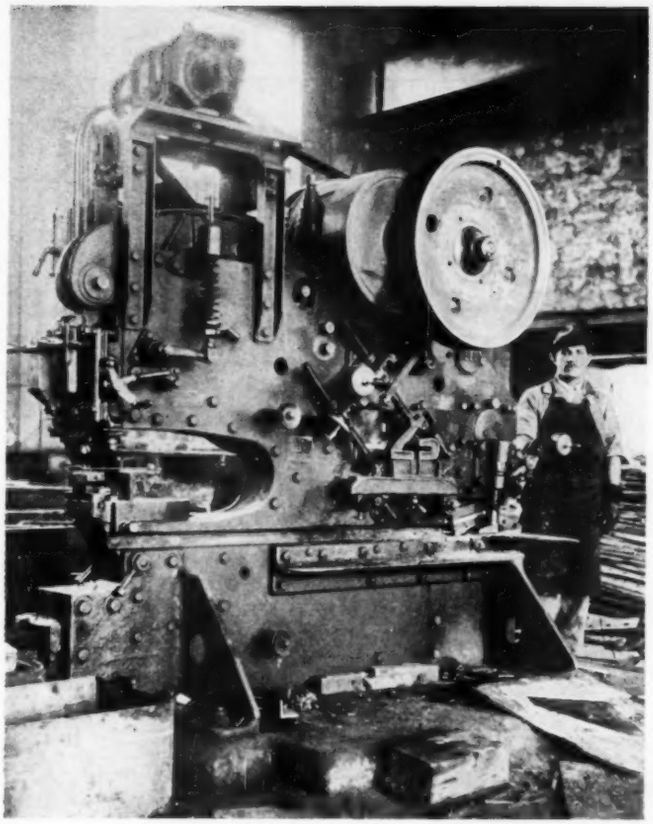


In order to get across the idea of how a job should be done, the apprentice group studies a projected drawing of the part and, led by the instructor, develops the sequence of operations necessary to perform the work

A complete course for training purposes has been worked out from functional parts of Monarch lathes, each job having been graded for a "difficulty level" by the foreman in the shop. As students progress from department to department, each can grow at his own speed and acquire successive increments of trade skills. It should be noted that all trade training programs must be tailor-made to suit its own industry. The procedure is to make analysis of the processes in the plant in order to find out what should be taught. We have divided the trade training program into blocks such as lathe work, milling, drilling, and so on. These blocks are further divided into units, such as threading, boring, reaming and other operations, for practical application. Each unit has a check or test sheet. These sheets are multigraphed and are designed in line with modern teaching practice. These tests have the following advantages, (1) they do not favor the verbalist or those students who have had an extended formal education, (2) they are objective and may be checked by several people for the same score, and (3) they are easy to score.

Our school consists of a theory room and a reference library for formal class work and ungraded discussions and conferences. A laboratory is provided for technological experiments and machine demonstrations. The main branch of the school is the shop itself and related material is studied on the shop floor as it is required to complete the job; this is made possible by the use of job sheets. Such sheets have many forms and should contain the following: (1) an information paragraph explaining the functional purpose of the job—the work it has to do and its value to the finished product, (2) a clear understanding of the blueprint dimensions and selection of materials, (3) guidance in selection of tools for the job, (4) directions for setting up the work, (5) instructions for machine adjustment—tool angles, speeds and feeds, (6) the sequence of operation steps in processing the work, and (7) several thought provoking questions to be answered by the student in order to check the instructions. Sources of additional information in mathematics, science, theory or safety should be clearly noted, that is, book, page and paragraph should be noted on the job sheet at the point where such material is deemed essential.

Foreman training is handled in a different manner, since most of the foremen came up from the ranks and have had long service with excellent training in the requirements of the job. With this as a foundation, the school attempts to build a superstructure of personal efficiency and advanced management practices. The growth of the Monarch Company has demonstrated that the purposes and policies of the company must be understood and administered by an ever growing group of officials. The subjects for the foremanship classes are selected on this basis. Classes are limited to about fifteen students and the courses are short and intense.



Mexican Tramway Shops

Street cars in Mexico City are built and repaired with modern machines and welding equipment

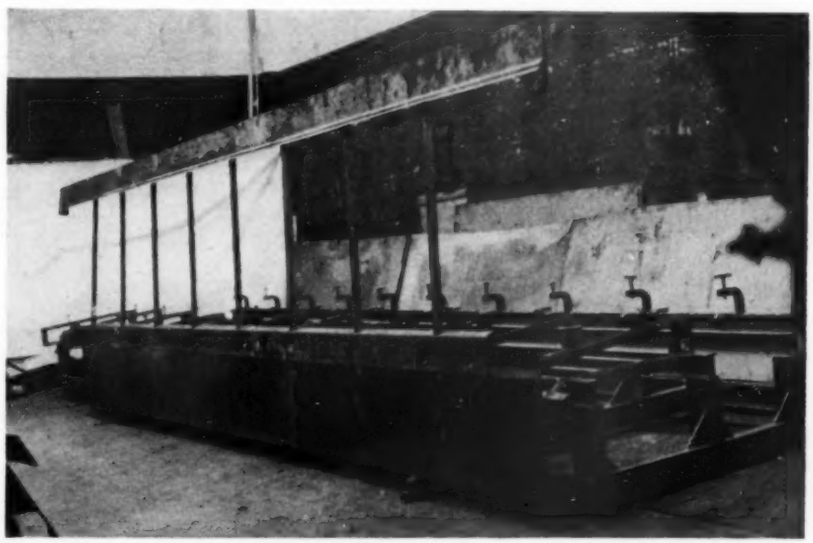
Pels shears for cutting, cropping and punching structural shapes for street car body frames in Mexico City car shops

THE Compañia de Tranvias de México, S.A., or Mexico Tramways Company, furnishes all local rail transportation in Mexico City and its environs. In spite of being in the mountains at an elevation of about 7,500 ft., it has no grades to contend with, for this whole region is a vast plateau surrounded by mountains that require climbing 1,000 to 3,000 ft. to leave the city. One of the advantages of operating a road on level terrain is shown by the extremely high mileages secured with steel tires and chilled-iron street car wheels; the average life is 350,000 miles, but some tires and wheels have given as much as 600,000 miles of service before repair or renewal. Braking on roads of this kind is confined to making passenger stops, speed control being unnecessary because of the absence of grades.

The car repair shops of this street railway are in Mexico City and employ about 800 men. The shops have their own cast-iron and brass foundries, and rebuild bodies when cars are damaged or need renovating. Car bodies are built completely when new and improved designs are evolved.

When building new cars, parts for the steel frames are sheared, cropped and punched in a Pels machine. Plates for the car sides, roof and vestibules for rebuilt and new cars are cut to size in a Rhodes shears and completely assembled by welding. Frames for new cars, as well as sheathing and supports for the sides, ends and roofs, are welded with the aid of a fixture which holds the various members in position and prevents warping. The fixture was built up by welding suitable structural shapes and angle bracing; it is leveled by wedges to secure the desired flatness of the completed steel work.

United States machinery is represented by a number of machine tools. A Warner & Swasey turret handles a large variety of lathe work, never made in large quantities in a shop of this kind. It indicates the growing use of turrets in small quantity production, largely due to the standardized and simplified tooling devices which have been developed.

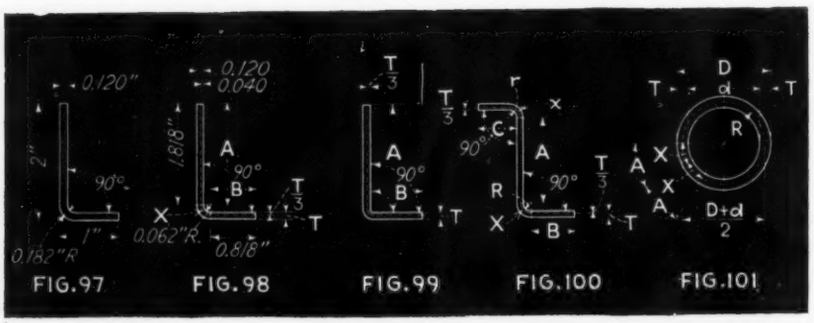


Steel body frames and sheathing for car sides, roof and vestibules are assembled by welding in the illustrated fixture. A completed side is shown as it comes from the fixture ready for assembly on the car

Blank Development for Work With Bends

Using a typical cover as an example, the sequence of developing the blank, scrap strip, and jig boring layout leads to a suitable blanking die design

C. W. HINMAN
Tool Engineer
Kobzy Tool & Electric Mfg. Company



Figs. 97–101—Actual over-all dimensions of the blank are found by redimensioning the piece from the inside of the bends and adding allowances for stretching the metal at the radii, according to formulas given

IF A BLANKING die were ordered for work that is to be partially or completely formed, a blank development of the piece must be made before starting the scrap strip layout.

Developed lengths are computed from the *inside* dimensions of the bends; these dimensions locate the radial centers that describe the bends. If the dimensions of the formed piece are given *outside* the bends, as in Fig. 97, then a preliminary sketch similar to Fig. 98 should be made from which the flat blank dimensions can be accurately computed. The dotted lines in the sketches represent the neutral bending lines.

Blank Development

If L is the required developed length of the flat sheet metal blank for Fig. 98: Then, $L = A + B + X$, in which $X = [(T \div 3) + R]$ 1.5708, for a 90-deg. bend. For any angle, $X = [(T \div 3) + R]$ $0.01745N$, in which N is the number of degrees in the angle. If the angle is given in degrees, minutes and seconds of arc, N must be reduced to a whole number and decimal fraction before it can be used in the formula.

Practice has shown that for 90-deg. sharp-cornered bends, Fig. 99, the developed length is sufficiently accurate when calculated as follows: $L = A + B + (T \div 3)$. For two bends in opposite directions, Fig. 100, $L = A + B + C + X + x$. For circular tubes, Fig. 101, when R is greater than $2T$, the neutral bending line is central in the strip. This is also adopted for all bends where R is greater than $2T$. For the circular arc length of a sector X, Fig. 101, $L = 0.01745 \times A \times R$.

The foregoing bending formulas, while based on the correct geometrical theory, give developed lengths slightly oversize because the metal stretches. Recent tests seem to show that $T/5$ gives more accurate results for the position of the neutral bending line than $T/3$. This is particularly true for the commonly used U. S. gage sizes from No. 10 to No. 24.

Typical Development

Five views are shown in Fig. 102 of a sheet steel cover for which blanking and forming dies are required. For the blanking die, sections *A—A*, *B—B* and *C—C*, are drawn and the lengths developed. In determining these lengths, the remaining dimensions follow easily. These five views are shown dimensioned in skeleton fashion. *Inside* dimensions would be calculated for each of the three sections, and allowances made for the bends, as discussed with Figs. 98–100. The sections can be sketched free hand to save time, but if the work were very small, or otherwise complicated, it would be best to lay out the sections ten times the actual sizes.

By using the previously given bending formulas and methods, the developed lengths for the sections are: 3.041, 4.448, and 3.318 in. respectively, as shown in the sectional views. The completed blank development is given in Fig. 103. Developed lengths of the three sections are inserted as shown underlined, and the remaining flat dimensions can be taken directly, or are obtained from the formed cover in Fig. 102.

The scrap strip is dimensioned as illustrated in Fig. 104. This particular blank is to have four of its sides formed or bent. Therefore, the blank is positioned at a suitable angle across the strip grain in order that all of the bends can be made without danger of fractures. Solution of several right-angled triangles, as shown, is a mathematical check that proves the practicability of this design. It shows that the scrap allowance between the blanks and edges exceeds the material thickness.

Jig-Boring Layout

One of several types of jig-boring layouts for the cover blank is presented in Fig. 105. The block has been turned 22½ deg. from normal to bring all the die dimensions "straight," and to coincide with the straight dimensions on the blank in Fig. 103, and with those in Fig. 104. This maneuver avoids solving many triangular computations. The block is secured on the jig-boring machine in the position shown in the figure. In this way, most of the dimensions can be taken directly from the blank development in Fig. 103, and with only slight changes the dimensions can be incorporated in the layout.

The centers of all exterior radii must also be located. In Fig. 105 are two $\frac{1}{16}$ in. exterior radii. A $\frac{1}{16}$-in. diameter hole is drilled at these centers, and a hardened shoulder button 0.125 in. diam. is subsequently fitted in the holes and used as a filing templet for outlining these radii in the die. Stepped dimensions in the figure are purposely omitted.

The Blanking Die

Fig. 106 represents a die of the "blank through design"; it uses the die block shown in Fig. 105. This blanking die is one of the smaller types, sometimes referred to as a "drop through die" because the cut blanks drop through the die block, the die shoe and bolster plate, and then out through the press bed.

This press tool is designed for use in a No. 3 non-tilting gap press. The strip is passed by hand along the feed table, at the right, and under the channel stripper plate fastened on the die. The strip is halted at blanking centers, for tripping the press and cutting the blanks. Halting of the strip is controlled by the automatic action of a stop lever shown at the left. The mechanical operation of several types of automatic stops has been previously explained.

To design the die block, draw and position the blank, full size, as it will

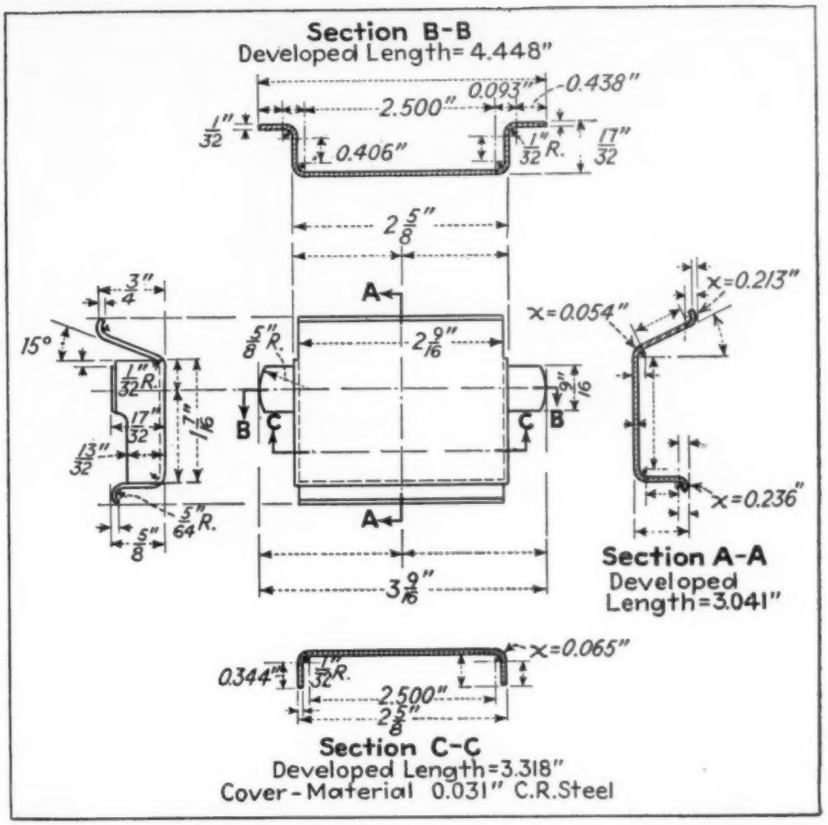


Fig. 102—To assist in drawing the blank layout, the part drawing is sectioned at important locations and the developed lengths of the sections are computed. Dimension lines and some dimensions show the method

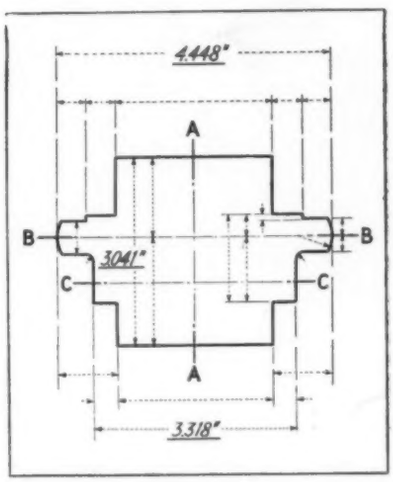
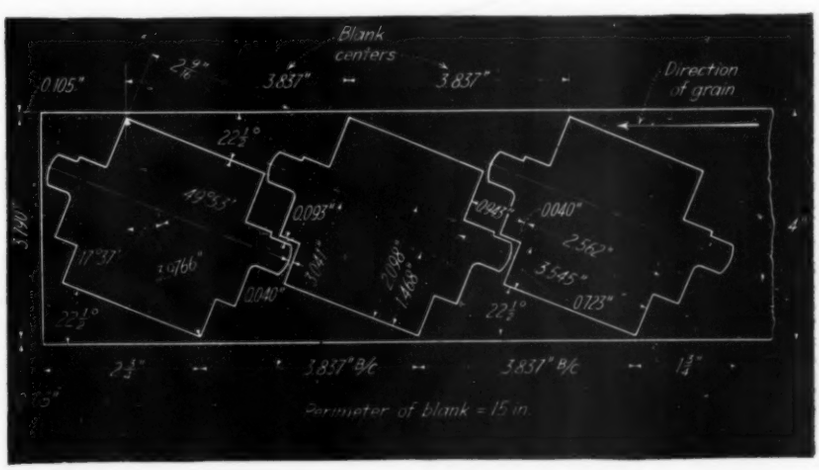


Fig. 103—By using the developed lengths of the three sections in the part drawing plus dimensions from the part, the blank layout is accurately determined

Fig. 104—Since the blank is light gage material, the 22½ deg. angular position of the blanks across the strip grain is ample protection against fracture



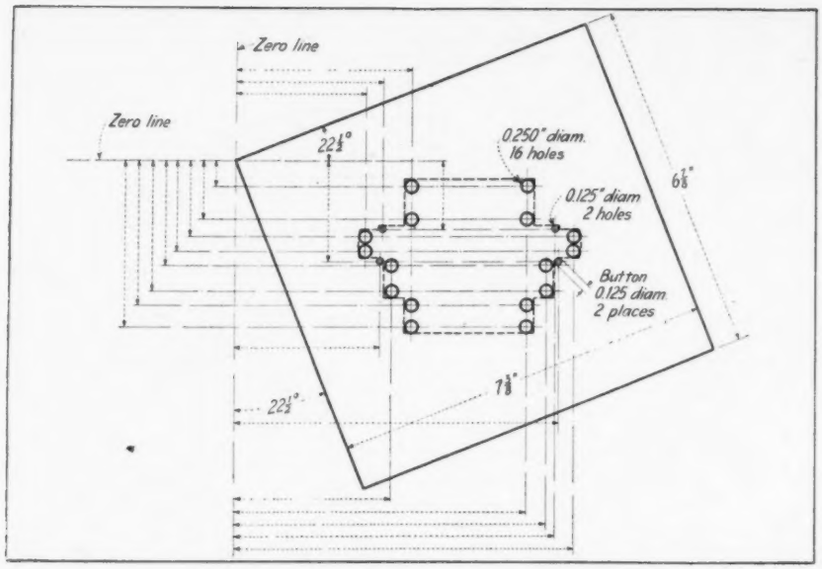


Fig. 105—By turning the die block 22½ deg., the dimensions of the jig boring layout are brought "straight," saving solution of many triangles

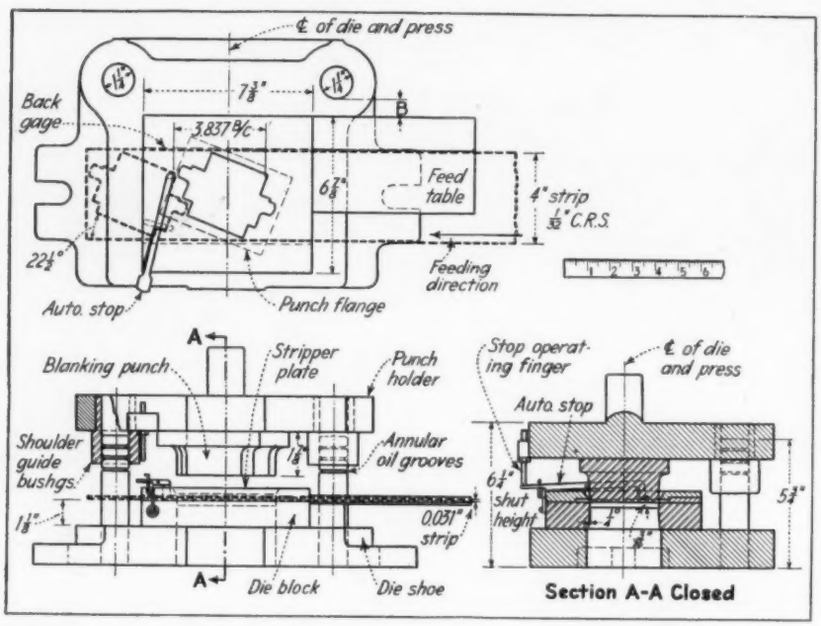


Fig. 106—A "drop through die" for the part can be used for blanking on a gap press because the tonnage required is comparatively light

appear in the die. Proportion the outlines of the block symmetrically around the blank to suit the blank size and hardening conditions. Block thickness depends upon the quantity production expected from the die. The thickness may vary from ⅝ in. for low requirements up to 1⅜ in. for medium-sized parts in continuous runs and high production. Faces of punches and die blocks must, of course, be ground for sharpening. Usually about 0.005 in. is ground off each time these members are sharpened. High production blanking dies are often ground until they fail by fracture. The die may stand up even after being reduced to ¼ in. thickness by repeated grinding.

Selecting the Die Set

The die set used in Fig. 106 is a standard type with two posts in the rear. Size of the die shoe should allow space around the die block for possible future additions, such as feeding devices and vertical rollers designed to force the strip against the back gage. The spaces shown in the figure are about right. Space *B* is ⅝ to ¾ in. for clearance between the guide posts and the nut on the grinding wheel, to facilitate grinding the die. Space *B* also provides clearance between the stripper plate and the shouldered guide bushings, when the ram descends, and after the tool has been ground to where the shut height has been reduced to the point where interference with the fillets on the guide bushing bosses would result if there were no clearance.

Part 19 of Mr. Hinman's series will be published in an early number.

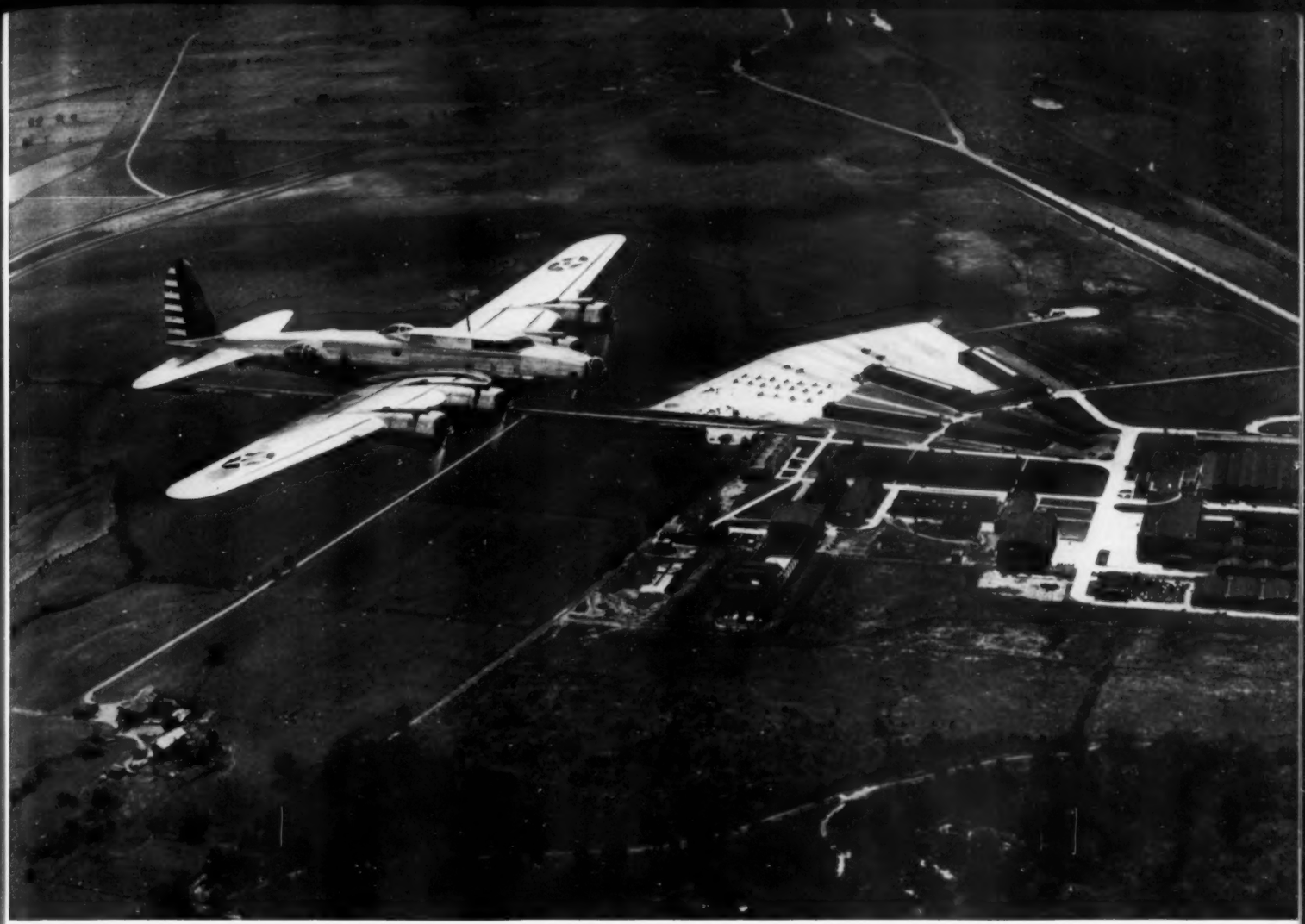
Machines Designed for Easy Cleaning

By JOHN E. HYLER

ONE OF THE things the designer does well to keep in mind is the fact that an easily cleaned machine or piece of equipment is superior in the eyes of the user and by that token will be sure to find a wider welcome. One of the chief features of easy cleaning, naturally, is a smooth outline. It is possible, in the great majority of cases, to design so as to avoid dirt traps.

Too often, socket-headed setscrews and capscrews, for instance, are considered entirely as safety measures. While the safety they provide is certainly important, there are many places where it is entirely safe to use a protruding setscrew, or protruding capscrew heads, where it is inadvisable from the standpoint of easy machine cleaning. In the case of capscrews, use of a socket-head screw, set into a countersunk hole, allows having the screw head flush with the surface, or practically so. Where this is the case, one can go over it with a wiping rag or with a handful of waste, as readily as though it were not there.

Another thing in reference to cleaning, which is a decided bugbear to many machine users, is the proposition of exposed threads, which gather dirt and work stiffly in consequence. By the simple expedient of cutting a groove directly across the threads on a part, they can be made self-cleaning. The threading, in combination with the groove, continually works such dirt as may gather in the threads, into the groove. The groove need be no deeper than the roots of the threads, though it may be a bit deeper without doing any harm. It is wise, in the case of non-rotating threaded members which lie in horizontal position, to have the cleaning groove located on the under side, so that dirt working into the groove, will drop away by gravity.



Typical of U. S. air force is the Boeing Flying Fortress over Wright Field

WINGS FOR DEFENSE

AIRCRAFT has recently zoomed across the sky as a major military weapon. It played a decisive role at Munich last September. It has retained the spotlight ever since.

No man can foretell the eventual place of aircraft as a military factor. It is enough to say that the United States, along with other democracies, has decided that for self-protection it must have a sizable air force.

Such an air force would be ineffective, however, unless proper maintenance facilities were provided. For an airplane is self-sustaining only during the time it is in flight. Routine inspection and minor repair work on planes are of an exacting nature. Engines are completely disassembled and overhauled after specific hours of flying time. Periodically, a major overhaul of planes themselves is necessary.

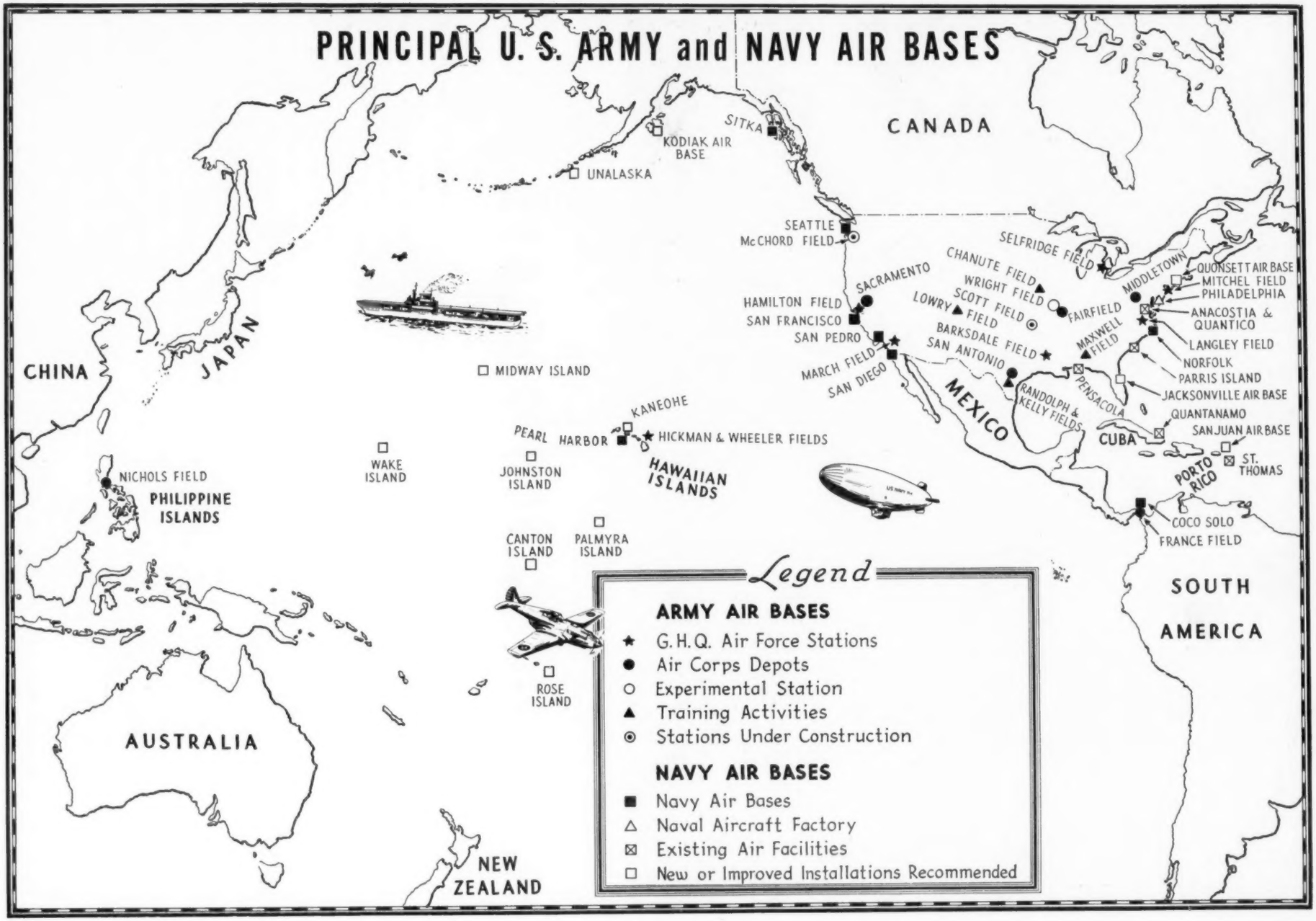
For such operations a large staff of well-trained ground crews and skilled workmen is essential. Just as important as the men is the equipment, particularly machine tools, with which to do the job. This equipment must be of modern design, otherwise precious time is lost in making repairs. And planes are of value only so long as they are ready for service.

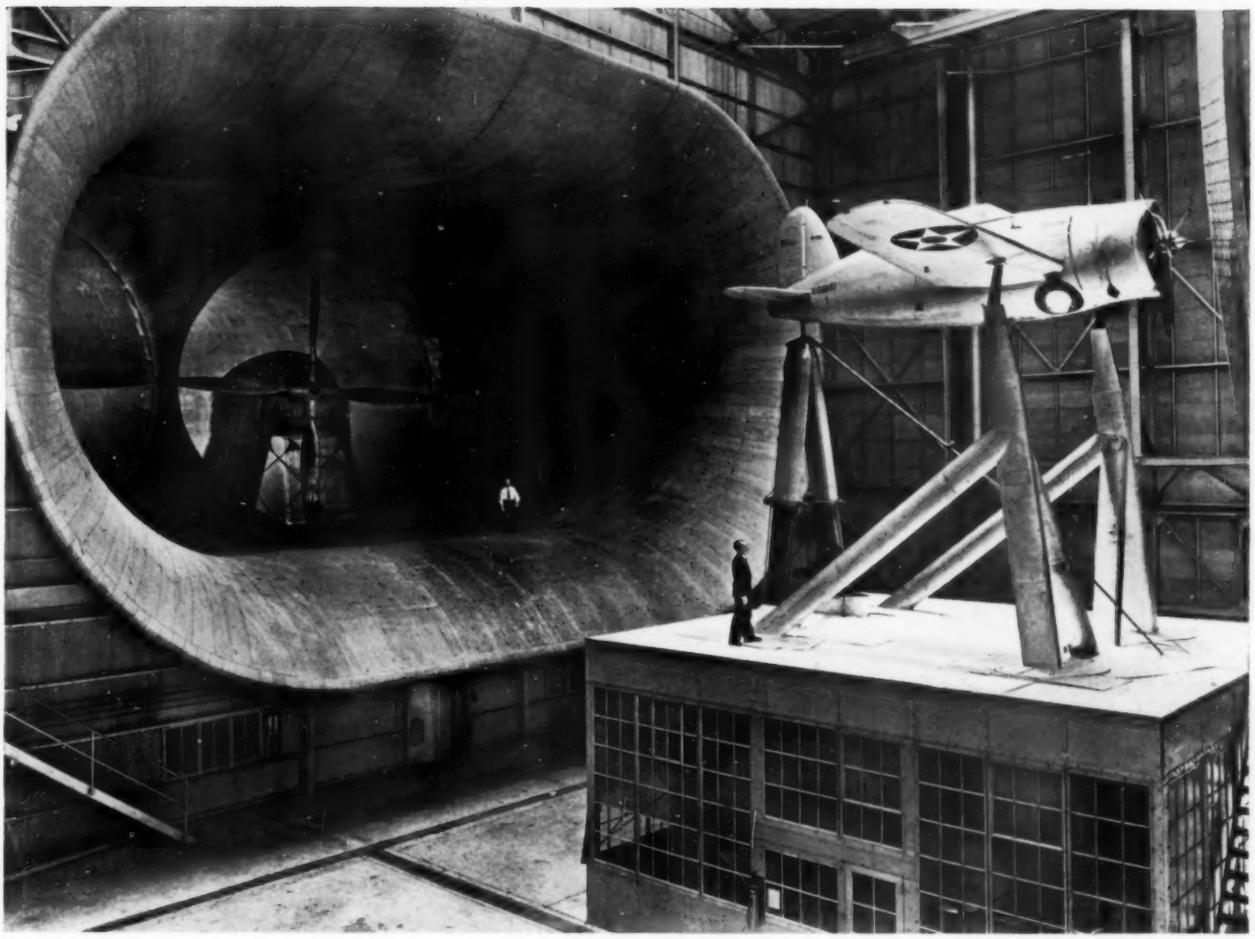
Aircraft is fast moving not only in flight, but also in design. The up-to-date plane today is superseded by a newly-designed one tomorrow. Thus research and development work on a vast scale, along with a strong air force itself, is the essence of air defense activities. Research and development cannot be carried on most efficiently without adequate equipment, yet much of it at Wright Field dates back to world war days.

Congress has authorized the Army to increase its first-line planes to 6,000 units. The Navy's air fleet too is to be greatly enlarged and twelve additional air bases probably will be established. In this haste to expand the air force, one must not lose sight of the necessity for ground facilities keeping pace with the increased number of planes.

More machine tools for repair and overhaul work are needed. Old machines must be replaced by modern tools, because even the highest skilled worker cannot do the sort of precision job required on a modern plane part unless he has machinery of present-day accuracy. More buildings large enough to house the big bombers and other giant fighting planes are essential.

Because research, testing, maintenance and overhaul facilities are vital to an effectively functioning air force, *American Machinist* presents on the following pages a survey of these branches of government aviation and of the equipment which they now possess for doing their assigned tasks.


PRINCIPAL U. S. ARMY and NAVY AIR BASES
CANADA
SITKA
KODIAK AIR BASE
UNALASKA
SEATTLE
McCHORD FIELD
SELFRIDGE FIELD
CHANUTE FIELD
WRIGHT FIELD
SCOTT FIELD
LOWRY FIELD
SACRAMENTO
HAMILTON FIELD
SAN FRANCISCO
SAN PEDRO
BARKSDALE FIELD
SAN ANTONIO
MARCH FIELD
SAN DIEGO
FAIRFIELD
MAXWELL FIELD
MIDDLETOWN
QUONSETT AIR BASE
MITCHEL FIELD
PHILADELPHIA
ANACOSTIA & QUANTICO
LANGLEY FIELD
NORFOLK
PARRIS ISLAND
JACKSONVILLE AIR BASE
QUANTANAMO
SAN JUAN AIR BASE
ST. THOMAS
PORTO RICO
COCO SOLO
FRANCE FIELD
CUBA
MEXICO
RANDOLPH & KELLY FIELDS
PENSACOLA
CHINA
JAPAN
MIDWAY ISLAND
KANEOHE
PEARL HARBOR
HICKMAN & WHEELER FIELDS
HAWAIIAN ISLANDS
WAKE ISLAND
JOHNSTON ISLAND
NICHOLS FIELD
PHILIPPINE ISLANDS
CANTON ISLAND
PALMYRA ISLAND
ROSE ISLAND
AUSTRALIA
NEW ZEALAND
SOUTH AMERICA
Legend
ARMY AIR BASES
★ G.H.Q. Air Force Stations
● Air Corps Depots
○ Experimental Station
▲ Training Activities
⊙ Stations Under Construction
NAVY AIR BASES
■ Navy Air Bases
△ Naval Aircraft Factory
⊠ Existing Air Facilities
□ New or Improved Installations Recommended



This 30x60-ft. wind tunnel at the N.A.C.A. Laboratory, Langley Field, Va., is used to investigate important factors involved in the flight of full-size airplanes. It is outstanding among the wind tunnels of the world

LANGLEY FIELD IS THE HOME OF THE N.A.C.A.

LYING BETWEEN the James and York Rivers in Southeastern Virginia is a narrow strip of land known as the "Peninsula." Near its tip and in close proximity to Newport News and Hampton, Va., is Langley Field which today is the most important air base for combat and observation units of the Army air force. Sharing the field with the Army Air Corps is the Langley Memorial Laboratory of the National Advisory Committee for Aeronautics, one of the world's outstanding aeronautical organizations.

The field was founded in 1916 when Congress appropriated $300,000 upon advice of the Army Signal Corps for the purchase of land in a locality where climatic conditions were such as to permit the maximum number of good flying hours per year. Better locations further south might have been selected in this regard, but southeastern Virginia offered rapid and convenient communication with Washington and airplane factories in New York, Pennsylvania, New Jersey, Massachusetts and Ohio.

Langley was originally intended as a permanent inspection and experimental station for the Aviation Section of the Army Signal Corps. It was designated as a base where planes could be designed, built and remodeled, where aircraft engines, structures, instruments and material could be tested, and where aerodynamic tests of model and full-size planes could be conducted. These functions were later transferred to Dayton, Ohio, (McCook Field, since abandoned) except for fundamental aeronautical research which had been specifically assigned to the N.A.C.A. Space for the necessary laboratory facilities was allotted to that organization at Langley Field shortly after its establishment.

The National Advisory Committee for Aeronautics was established by an act of Congress in 1915 for supervising, directing, and conducting fundamental research and experiments in aeronautics. Because the existing aeronautical research facilities in the United States were inadequate, a laboratory was established at Langley Field in 1916. The equipment at the laboratory has been continuously increased to provide suitable research facilities for the constantly expanding civil, Army and Navy air services.

The designers of modern airplanes rely to a great extent on information provided by the N.A.C.A. Increased speeds, range, and reliability of airplanes can to a large extent be attributed to the research conducted at the laboratories of this organization.

Many outstanding airplane innovations have been developed, including the N.A.C.A. cowling and wing-nacelle location, and a number of air-foil sections.

More than fifteen wind tunnels, each built for a specific type of research, are now in operation. In addition there is a seaplane testing tank, an aircraft-engine laboratory, a flight-test laboratory, and miscellaneous associated equipment. The seaplane testing tank is about 3,000 ft. long, having a carriage with a speed of approximately 80 m.p.h. which is used for the investigation of seaplane floats and hulls; design data is procured for the construction of the modern transoceanic commercial planes and the modern seaplanes in use by the Navy.

Outstanding among the wind tunnels is one with a test section of 30x60 ft. in which a moderate full-sized airplane can be mounted to investigate the important factors involved in flight. Another interesting tunnel is one of 8-ft. section in which models and small portions of airplanes can be subjected to wind velocities of more than 500 m.p.h. Two high-speed tunnels, operated in conjunction with a variable-density tunnel for testing small model planes and air foils, have throat diameters of 12 and 24 in., respectively, in which air velocities of approximately 750 m.p.h. can be obtained. There is also a propeller-research tunnel and a free-spinning tunnel in the latter of which airplane models are studied to find and eliminate bad spinning characteristics.

The N.A.C.A. Laboratory maintains machine, sheet-metal and instrument shops for the development, production, and repair of airplane models and instruments required in research. Upon the completion of the tests on engine cowling, fuselage, wing and tail surfaces, and control surfaces, these parts are manufactured in the sheet-metal shop located in a hangar adjacent to the flying field. The hangar houses the experimental planes to which the parts are applied for testing in actual flight.

The present machine and instrument shop facilities are in a small two-story brick building, but because of the lack of space a machine shop annex is located in the full-scale wind-tunnel building. In this annex is a 42-in. x 12-ft. planer fitted with a high-speed motor-operated milling head mounted on the cross slide, which is used for cutting large air foils. Other equipment includes a 30-in. lathe and an Oliver woodworking machine converted to contour air foils.

The machine shop is equipped with standard tools usually found in small job shops, including planers, shapers, millers, drill presses, and small bench units. A Do-All job selector is used for cutting intricate shapes such as single wing sections for model planes and separate plane parts used in wind-tunnel tests. The shop has an air-foil cutting machine, which is the only one of its kind in existence; the cutters of this machine are operated by followers rolling against the periphery of templets, the shape of which correspond to that of the designed air foil. The foils, cut from solid stock, are fed through the machine and finished in one set-up.

The instrument shop is equipped to manufacture, service and repair all instruments used in flight research. These are of the photographic-recording type and are developed at the laboratory because the experimental work on which they are used is usually of a special and exacting nature.

All the equipment in these shops is being moved currently to a new

The N.A.C.A. machine shop is equipped to make full-size plane sections and to build model planes for the study of flight characteristics in wind tunnels. The 6-ft. radial drill shown is positioned to bore and drill air duct holes in an air-foil scavenging section

More than fifteen wind tunnels are now in operation at the N.A.C.A. Laboratory at Langley Field. This view shows the 8-ft. high-speed tunnel, the full-scale tunnel and the 12-ft. free-flight tunnel

Models of flying-boat hulls are tested in the 3,000-ft. N.A.C.A. towing tank. Speeds up to 80 m.p.h. are attained in procuring data for the construction of transoceanic flying boats and Navy seaplanes

Propeller blades are inspected periodically for cracks. Steel blades are clamped in terminal electrodes of Magnaflux testing equipment and sprayed with iron-bearing liquid. When the blades are magnetized, north and south poles form on opposite sides of flaws

building which was completed last month.

The Army Air Corps undertakes three classes of airplane, or so-called echelon maintenance. The first is that performed by tactical or combat units, normally consisting of servicing, changing of integral plane units and the making of minor repairs; all these are undertaken in the hangars or on the field. The second consists of the refabrication of sheet-metal and fabric plane surfaces; repairs to fuselage, wing and control-surface structures; minor repairs to electrical equipment and instruments; repairs to plane control and operating elements; and the reclamation and salvage of damaged planes. These are undertaken at all major army air bases. Third echelon maintenance includes complete overhaul and rebuilding of planes, engines and instruments. Equipment, machinery and personnel required are such that it would not be economical to maintain them at each of the air bases; therefore, this class of maintenance is undertaken only at main repair depots.

First and second echelon maintenance are performed at Langley Field. The base engineering department, employing army-trained specialists, has three buildings all of which are adjacent to the hangars. The first is a 50x80 ft. building where parachutes are suspended and dried periodically. The second is a 60x380 ft. structure erected in 1918 as a plane hangar, but converted to a combined machine, electric, instrument, metal-working, paint and welding shop in 1934. The third is a 60x380 ft. building for airplane repair, inspection and reclamation.

The second shop building is of steel-concrete-brick construction with 80 per cent window space. One end of the shop is devoted to the repair of electrical equipment. Adjacent is a section where instruments are repaired and tested. Next is a propeller repair section, including Magnaflux testing equipment and propeller balancing apparatus. The machine and metal-working shops occupy the center and main portion of the building with machines located on both sides of center aisles and served by monorail cranes running the length of the building. All machines are staggered for accessibility and to obtain ideal lighting. Although all the machines in the machine shop, with the exception of two engine lathes, are at least 20 years of age, they are individually motorized and adequate for the needs of the shop. These include standard lathes, drill presses, planers, shapers, millers, horizontal boring mills and grinders. Bolts, nuts, pins, bushings, gears, brackets and hangars for control shafts, operating elements, landing gears, brakes, brackets for gun and bomb sights, engine mounts, instrument mounts and cabin accessories are typical of the work undertaken.

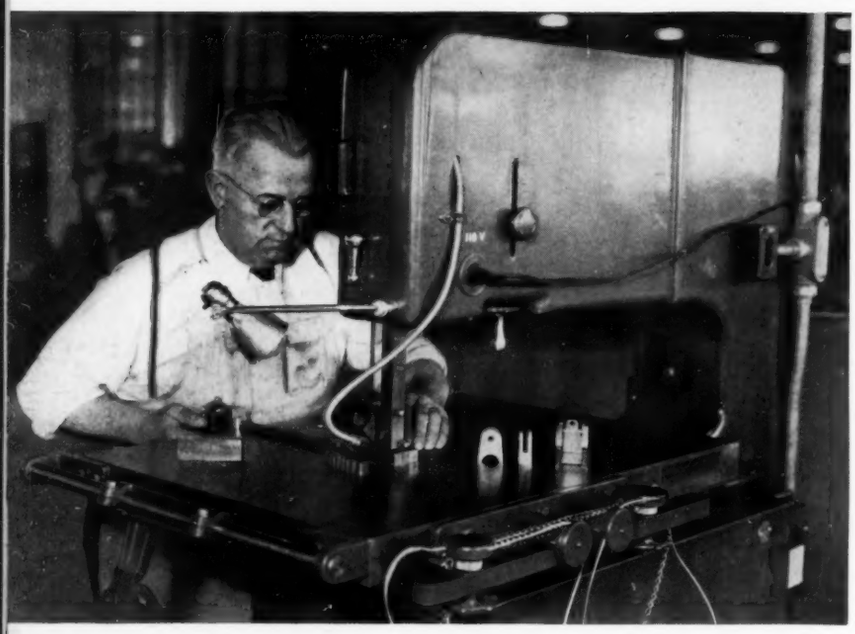
The sheet-metal shop has complete complement of bending brakes, shears, nibblers, punches used in the fabrication of miscellaneous metal parts for all types of aircraft. This work includes the covering of fuselage, tail and wing surfaces, the manufacturing of special installation brackets for navigation and control instruments, the fabrication of engine cowling and repairs to cabin accessories.

A section of the building is devoted to the repairing and manufacturing of engine radiators, engine manifolds, fuel, air and water tanks, and tubular parts for airplane frames. Gas welding predominates in this work, although electric welding is used to a limited extent.

At the south end of the shop is the paint and fabric section where all airplane control surfaces are covered and painted with a nitrocellulose solution which draws the fabric taut on drying. These are then spray painted in a room in which temperature and humidity are controlled to maintain ideal painting conditions.

Precision requirements are met, in so far as possible, with newer tools, such as this Monarch lathe, most of which have been purchased within the past two years. The operator is finishing the inside of a cast aluminum pump body to within a tolerance of —0.000 and +0.001 in. on the long dimension of the oval

The versatility required of tools used in the experimental shops is indicated by the wide range of uses to which this "Do-All" sawing and filing machine is put



WRIGHT FIELD

THOUSANDS of radiograms, tens of thousands of blueprints, thousands of copies of specifications and other printed matter turned out every month are but surface indications of the importance of the "nerve center" of the U. S. Army Air Corps —the Materiel Division at Wright Field near Dayton, Ohio.

Home city of the Wright Brothers, Dayton has been a focal point for army aircraft development since the World War. Beginning at McCook Field, this activity soon outgrew its temporary buildings and small flying field. Dayton citizens then presented to the government land a few miles east of the city for aeronautical development in honor of the Wrights.

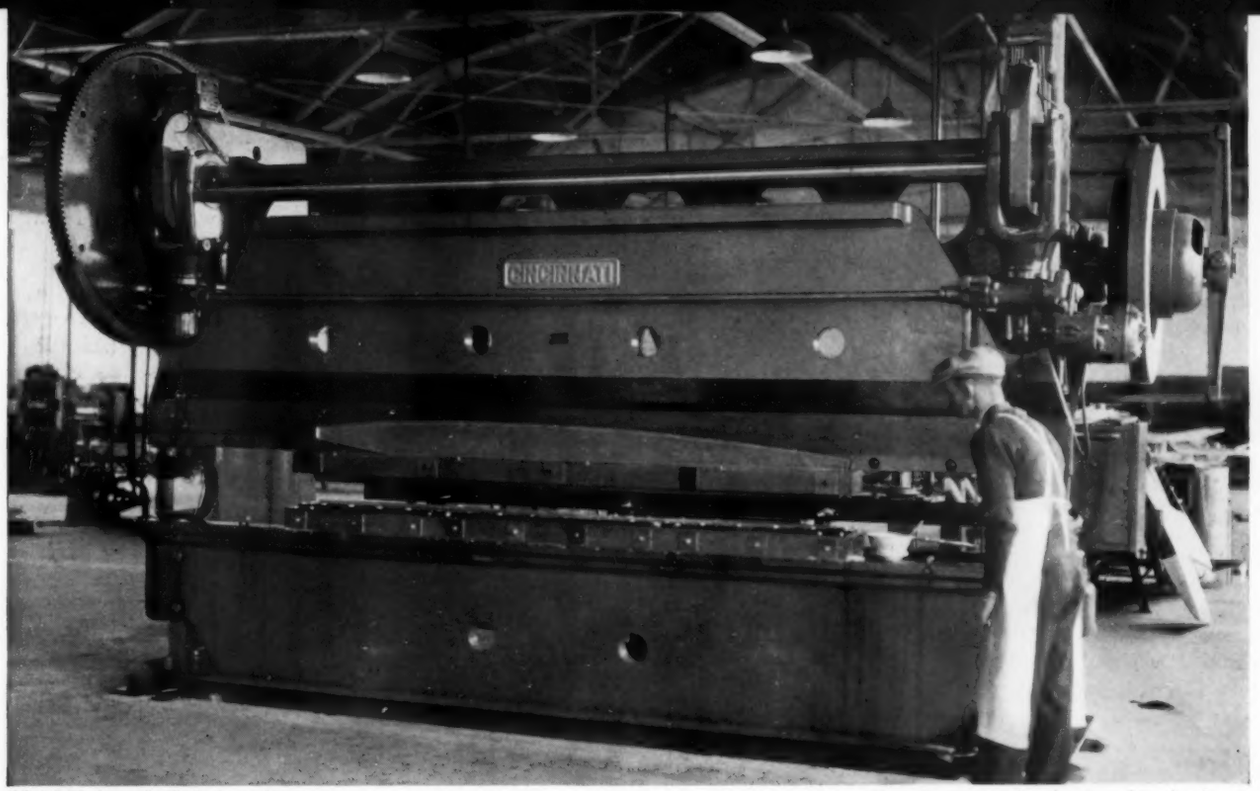
The field was dedicated in 1927 and its buildings therefore are comparatively modern. Much equipment dating back to the war was moved in from McCook Field and from other places. As a result of that policy 70 per cent or more of the machine tools are 20 years old.

The Materiel Division is the "purchasing agent" for the Army Air Corps. Employing today approximately 1,400 civilians and 100 officers, the division has as its primary aim the development, procurement and maintenance of airplanes, aircraft accessories and aeronautical material.

Charged with development of accessories and equipment in its own laboratories and shops, the experimental engineering section encourages and assists aeronautical developments by private manufacturers and other agencies. It is roughly divided into aircraft, materials, equipment (flight clothing, goggles, parachutes, life rafts and other similar items), power plant, photographic and aircraft radio branches. All of the Wright Field laboratories—dynamometer, static test, radio, wind tunnel, propeller test, torque stands, flight research—and the engineering shops are under its jurisdiction.

The aircraft branch of the experimental engineering section is constantly initiating new aircraft design, its job being to develop new types of aircraft and to improve those already accepted as standard. For this reason most of its work is experimental.

To assist in the work two small wind tunnels are used to determine performance of airplanes according to small scale tests. The dynamic and static test laboratory is a part of the aircraft branch. It tests various aircraft structures. In the past year, a method of testing which simulates actual loading in flight has been perfected.



Official Photographs U. S. Army Air Corps

Pressing metal ribs in this brake is an example of the need for adapting a limited number of machines to a wide variety of work. Laminated maple dies with sheet steel facing strips were used in this press for forming wing ribs six feet long

DEVELOPES FLYING EQUIPMENT FOR THE ARMY

The aircraft branch has developed pressure cabins for flying at high altitudes. Other development work has included retractable landing gears, nose wheel landing gears, wheel brakes and airplane skiis.

By means of its dynamometer laboratory, torque stands and fuel test laboratory the power plant branch has done its part in perfecting such engines as the 1,000-hp. Allison. Included in the dynamometer set-up is a "cold room" in which liquid or air-cooled engines are tested for starting and operating characteristics at temperatures down to —50 F.

All new or modified engines must pass a 150-hr. endurance test. These tests are run in a building which consists of a series of 40-ft. concrete stacks. Centered between the stacks are the torque stands, each stand being mounted on a huge block of concrete sunk 20 ft. into the ground and surrounded by cork to absorb vibration.

Tests and development work in the fuel laboratory have made practicable the use of fuels and lubricants of a higher quality than ever before attainable. As a result the weight per horsepower of engines has been reduced to about one-half that of war-time engines.

The materials laboratory is constantly experimenting to improve such products as oils, paints, varnish, fabric rubber, steel, aluminum, magnesium, beryllium base alloys and other important aircraft materials. The Army Air Corps was a pioneer in employing spot-welded stainless steel and has encouraged development of that material.

The Equipment Branch is responsible for such instruments as flight indicators, turn indicators, altimeters, compasses and engine instruments. It has done much lately to help develop aerial photography. Assisted by officers of the Corps of Engineers stationed at Wright Field, the growth of mapping by airplane has been rapid. Photographers of the Army Air Corps have made the highest altitude and longest distance photographs ever obtained. Other developments in connection with this were electrical heating of cameras for high altitude work and of clothing to be worn by aviators.

Much of the present-day progress in parachute work originated at Wright Field. Improved lighting installations for flying fields, blind flying methods and completely automatic landings are other Wright Field developments.

Proper mounting and operation of machine guns, bombs and ammunition are the primary concern of the armament branch. Instruments for accurate bombing, gun sights, machine gun synchronizers and mount-

Powerful electric motors mounted on concrete piers drive propellers in whirl test up to 4,500 r.p.m. The experimental engineering section has charge of this and other tests

ings for such equipment are part of the work carried on by this group. Signal and lighting flares and other pyrotechnical equipment are included, too.

The aircraft radio laboratory, under direction of Signal Corps officers working in cooperation with Air Corps officers, is charged with development of radios used in conjunction with army aircraft. Experimental and development work on interphone systems for multi-plate airplanes, antennas, radio compasses and many other similar items is included.

A laboratory is equipped to study the effect on the aviator of flights under various atmospheric conditions. Besides standard medical equipment the laboratory has pressure chambers which permit simulation of altitudes up to 80,000 ft. and temperatures down to —65 F. The laboratory is used to study and design equipment capable of overcoming ill effects encountered in flight.

Wright Field shops include metal-working, machine, wood, plating and paint. The materials branch has a small foundry, heat-treating department and forge shop. In no case do the shops compete with outside manufacturers. Their task is to make the first experimental models of equipment or accessories which would be too costly for an independent concern. Sometimes the ideas are in such an embryonic stage that it is simpler to control their development in shops where Air Corps engineers can follow the work closely.

When developments have reached a usable stage they are "frozen" by the production section and incorporated in new models. Once experimental ideas have been proved from an engineering standpoint and the shops demonstrate that it is possible to manufacture the items, contracts are given to commercial organizations for the desired number of parts.

The production section prepares specifications for aircraft, accessories and equipment, deals directly with the contractor, handles competitive bidding, and determines the winner after thorough engineering, flight and other tests.

To make sure specifications are followed, an inspection section has been established. All inspectors in the various districts and at manufacturers' plants are under its jurisdiction. Size of the contract and the amount of inspection required determine whether or not an inspector is permanently assigned to a specific plant. All acceptance tests, whether made at the factory or at Wright Field, are the responsibility of this section. At Wright Field the inspection section has a unit for local inspection in connection with experimental and development work. Much pioneering has been done there, for example, on Magnaflux methods of inspection.

Once accessories, equipment and aircraft have been accepted and turned over to service, the field service section becomes responsible for their storage, assignment to units, maintenance and repair. This work is handled at four depots, in the United States — Middletown, Pa., Fairfield, Ohio, San Antonio, Texas, and Sacramento, Calif. There are also depots at Hawaii, Panama and the Philippines.

Under direct jurisdiction of the Materiel Division chief, an industrial planning section is charged with organization of industrial establishments to secure adequate supplies for the Air Corps in time of necessity. It has no direct connection with other sections at Wright Field.

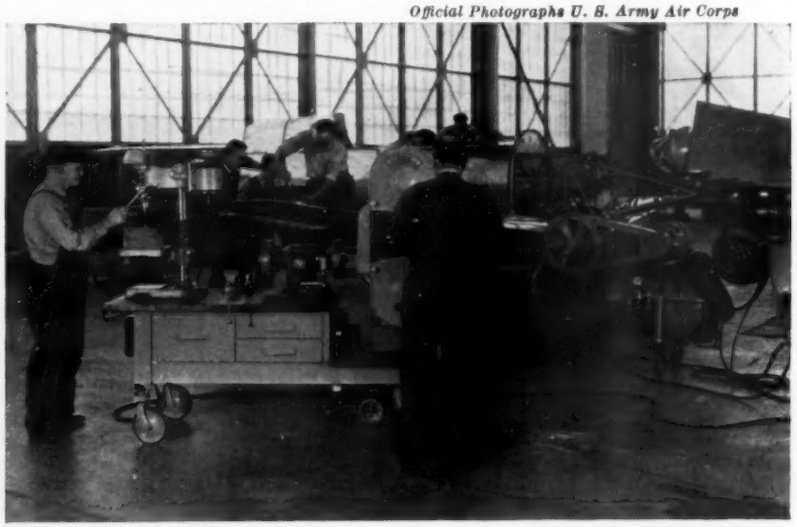
As mentioned, experimental designs of accessories or equipment (not aircraft) are often developed at Wright Field and the first models made there. For that reason, shops are arranged to do a wide variety of metal-working both on bar and sheet stock. Since everything is usually done only once, the set-up is relatively simple.

Hand work is often done because of the small quantities involved. For example, one experienced machinist makes all types of springs, usually one of each, winding them at a bench on mandrels designed for hand operation.

A great deal of shop work, mostly to close limits, is done on propeller, engine, instrument and radio parts. Armament, which in this case means bomb racks, gun mounts and similar equipment, calls for zero tolerances on many dimensions. Since a large amount of the work must be done on tools which are 20 years old, precision results are achieved by a combination of good shop practice and of work by machinists of long experience.

Official Photographs U. S. Army Air Corps

The assembly hangar, adjacent to the metal, machine and wood shops, is used when changes on airplane or installations for experimental or development purposes are made. Benches and scaffolds are portable



Preparing a wing for static tests requires a lot of small metal and wood parts especially suited to the job. Portable work benches, such as the one shown, save steps in such operation. Note the portable compressor

MIDDLETOWN IS ONE OF FOUR ARMY AIR DEPOTS

PRACTICALLY ALL the skilled trades are represented in the personnel employed at the Army's air depot at Middletown, Pa., for the inspection, overhaul and repair of planes, engines, propellers and flying accessories. The magnitude of these activities is well illustrated by a survey showing that about 40 minutes of maintenance activity is required for each hour that an Army plane is in the air.

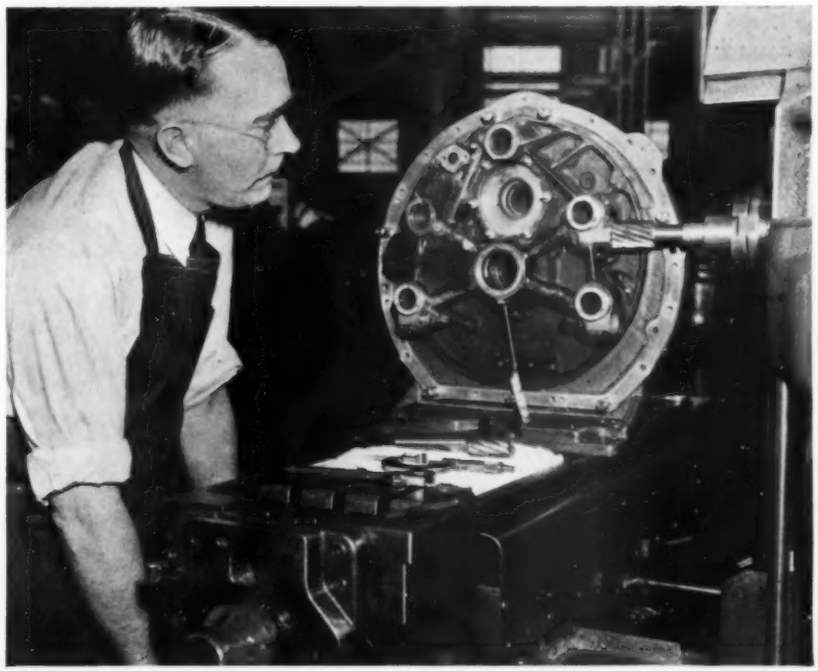
Operated during the world war as an ordnance supply depot, the Middletown station has been used by the Air Corps only since 1926 for plane and engine overhauls. A new shop building designed especially for that purpose was erected in 1936 and equipped, except in a few isolated instances, with new general-purpose machine tools, furnaces and other facilities which have been kept in good condition during the intervening years.

This relatively modern unit already is running to full capacity. Only by adding a second shift could the work be appreciably speeded up without adding new buildings and equipment. Even then an extensive training program for carefully selected mechanics would have to be carried out before a marked increase in productivity could be realized.

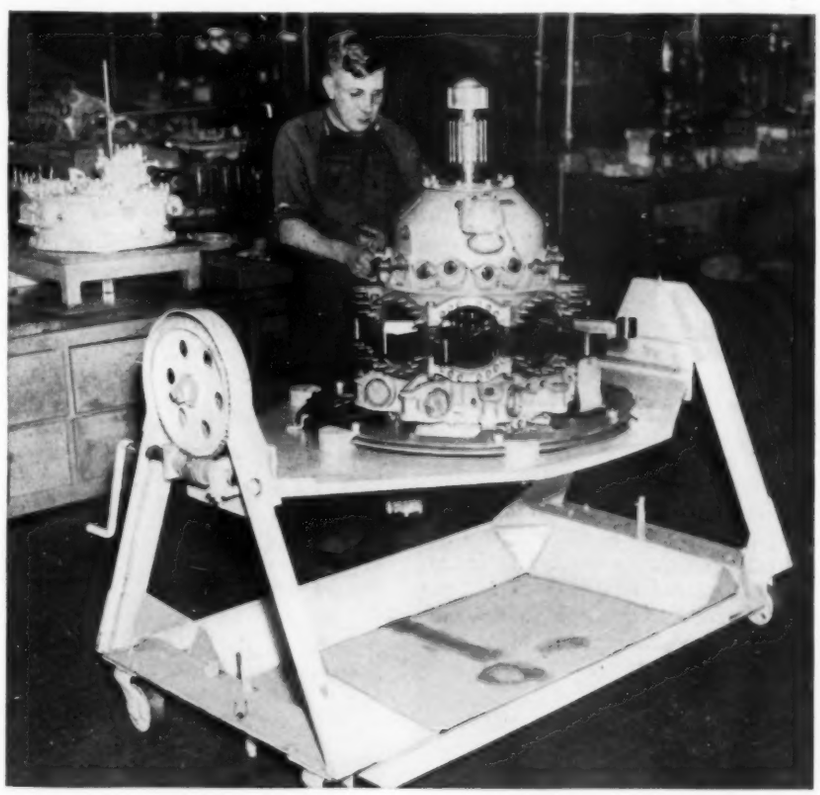
The rapid replacement of wood, wire and fabric with metals in airplane construction and the accompanying changes in engine design have placed a continuously heavier burden on the Army air depots. Not only has it been necessary for the facilities to be kept up-to-date, but the executive and shop personnel has been forced to develop and master new methods and to revise upward maintenance schedules.

In the early days of the air force planes were overhauled every eight to eighteen months, depending on the type, while today planes are checked over every 500–1,000 flying hours. Engines are completely torn down, inspected and reassembled every 300–350 hr. and must go on the test block for a 9–10 hr. run-in before replacement on a plane.

Three years ago one man working full time and another working only part time took care of all the propellers passing through the Middletown depot. Now, fifteen men are kept busy on this one task. This is due primarily to the fact that at present variable-pitch constant-speed



The overhaul of airplane engines and accessories at Middletown keeps a large machine shop busy. Here the operator is machining the wall of an accessory drive shaft bushing in a supercharger cover



After every part has been inspected and approved, repaired or replaced, the overhauled engine is reassembled on a universal fixture that can be set at any angle. Middletown handles about 50 air and liquid cooled engines a month

full-feathering propellers are used almost exclusively, and these require more man-hours of work than did the fixed-pitch propellers of yesterday for overhaul, adjustment and inspection.

The same relation holds for flying instruments, radio apparatus and electrical equipment. Also, landing gear assemblies now usually are of retractable design and are hydraulically actuated; a considerable change from the fixed type of gear in use only a few years ago.

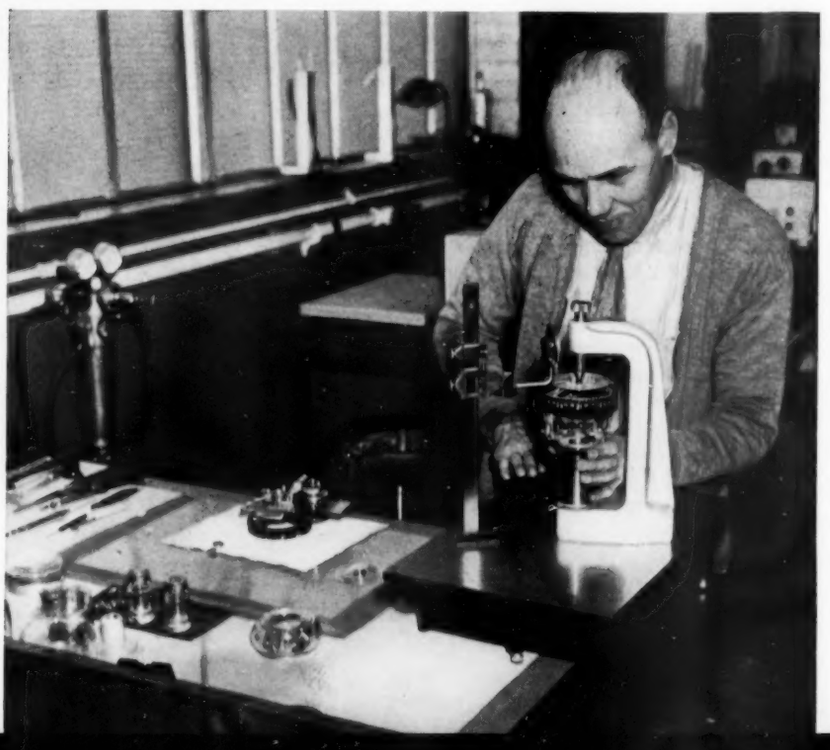
Replacement of fabric coverings for main fuselage and wing structures with metal sheets has decreased the load on the covering and dope rooms, but has increased the work of the sheet metal shop several fold. Today stainless steel is entering the picture and is bringing with it the problem of applying spot welding technique for many assemblies.

While they vary in size, all four Army air depots are equipped to perform major overhaul and essential routine and emergency maintenance operations on any of the Army's planes and engines. However, only the Sacramento and the Middletown depots have shop buildings of sufficient size to permit indoor work on completely assembled Boeing B-17 and B-15 bombers. In fact, the B-15 plane can be placed indoors at Middletown only by skidding it into the building sideways. The depots at San Antonio and Fairfield seldom are called on to do major repair work on such large units at present.

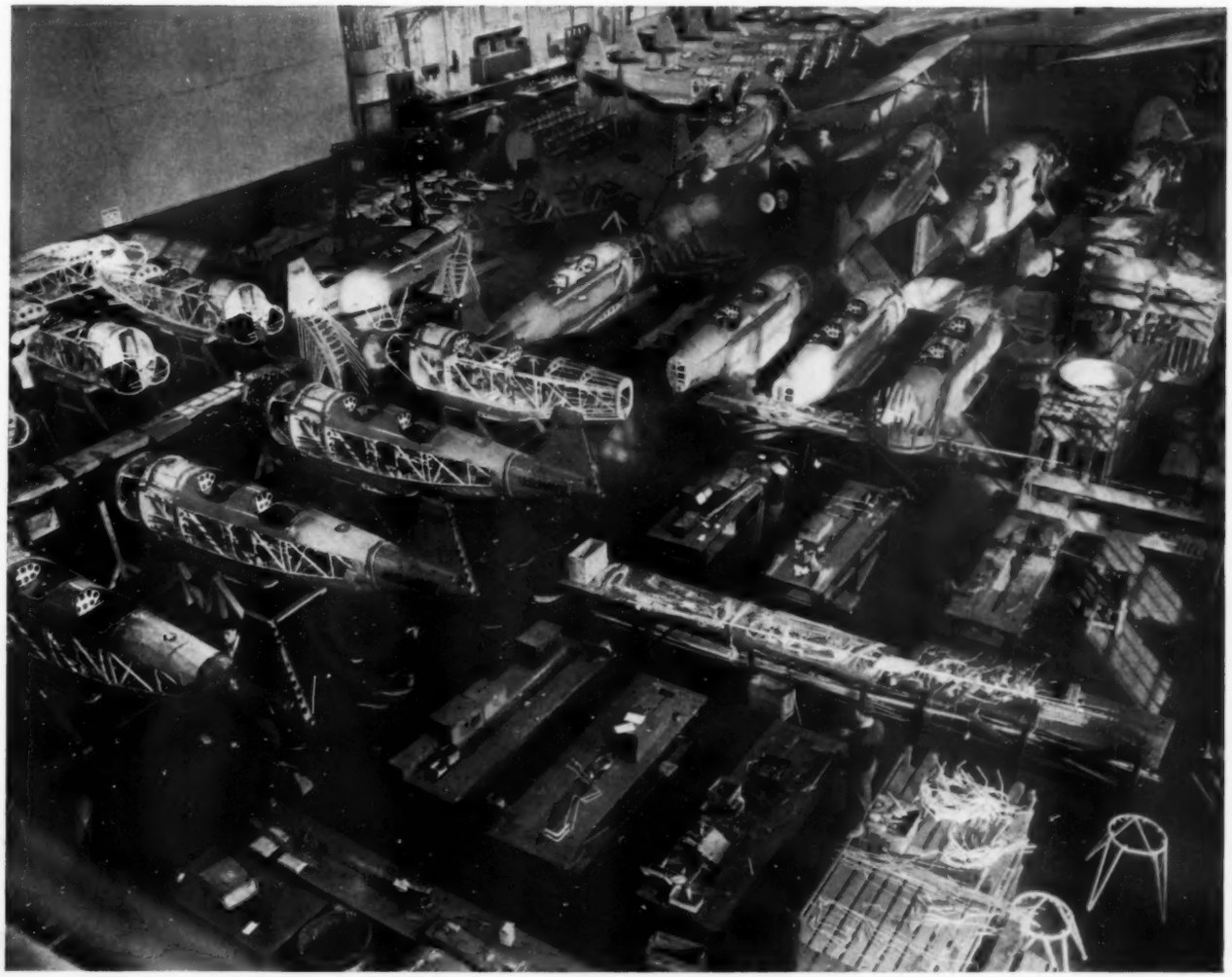
Stellite valve seats in cylinder heads are ground to a smooth finish within close dimensional tolerances on this special Wadell machine

Each engine is put through an exacting run-in test in one of six sound-proofed test cells located in a separate building. Each cell is adjacent to a control room where the inspector has before him a full set of instruments showing how the engine is performing

This instrument maker is overhauling an automatic pilot for one of the Army's largest bombers. The instrument room at Middletown is completely inclosed and is supplied with filtered air in order to prevent trouble that might be caused by dust



PHILADELPHIA MAKES ENGINES AND PLANES FOR THE NAVY

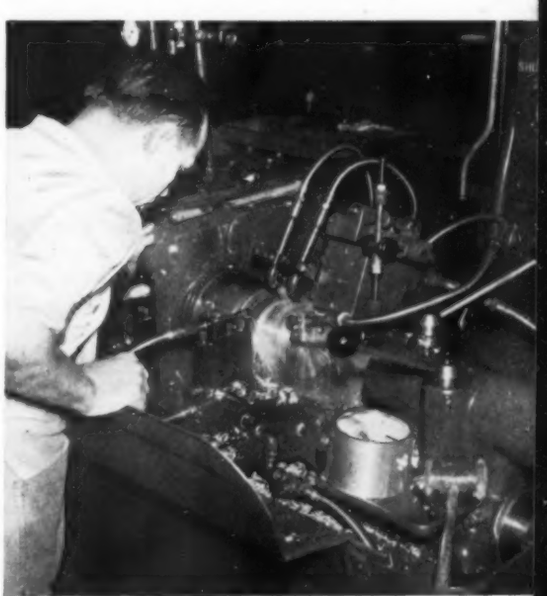


Planes are being manufactured at the Naval Aircraft Factory. It has been maintained primarily for the test and development of planes and aircraft material, and as a supply depot for Navy aircraft parts

THE Naval Aircraft Factory was founded during the World War at a cost of $5,000,000 on League Island in the Delaware River, the site of the Philadelphia Navy Yard. It was established originally to build flying boats and to assemble aircraft from parts manufactured in commercial plants in the vicinity of Philadelphia. Following the war, the nature of the work changed. It became a base for the experimental development of naval aircraft, the maintenance of fleet and air-base aviation units, and a central purchasing and supply depot for the entire naval aeronautical organization.

With the passage of the Vinson-Trammel Act in 1934, which carried the proviso that the Navy must build ten per cent of its airplanes, the factory was equipped to manufacture engines. A 32 x 104-ft. single-story building was erected and completely tooled for this purpose in 1936. Although only 100 engines have been built to date, production can be stepped up to 25 engines per week with little additional outlay for machinery and none for buildings. Since 1936 nearly 200 training planes have been built.

Since 1929 the design and construction of at least one experimental plane has been undertaken every two years, which constitutes the Navy's development work in this field. Specifications for adopted models are prepared and submitted to



Piston heads are turned, grooved and faced in a single operation on this Jones & Lamson automatic in the engine manufacturing shop

private manufacturers when contracts are awarded for quantity production. Other experimental activities include the testing and development of (1) all Navy aircraft engines and power-plant accessories; (2) metals, fabrics, paints, finishes and preservatives used in plane construction; (3) airplane structures; (4) catapults and arresting devices for landplanes; and (5) navigational instruments.

From time to time a number of model planes and spare parts are manufactured on a yardstick basis, that is, for a check of private industry costs; this is now one of the recognized peacetime functions of the factory. The check is not made on a monetary basis, but rather on a comparison of man hours for direct labor.

Another major function of the factory is the maintenance of planes for the fleet and air bases. It has become the supply base for all manner of spare parts, equipments and raw materials required by the entire Naval air force. In this connection, considerable manufacturing is undertaken, especially on parts for serviceable planes no longer in production at private plants as well as for parts required in small lots when the cost or time required for purchase from industry can be bettered.

The factory also has become an auxiliary overhaul base, taking care of service units stationed on the North Atlantic Coast and some emergency requirements of the fleet. This work includes the complete dismantling and repairing of all types of engines, seaplanes and landplanes.

The last but not least important function of the factory is the performance of numerous small and miscellaneous experimental and manufacturing jobs for the Bureau of Aeronautics.

The aircraft factory was originally a 400 x 400 ft. building, but before the World War armistice was signed there was erected a 1,080 x 300 ft. assembly building, a six-story warehouse, an administration building, a power plant, engine-testing facilities, plane hangars, an aircraft storehouse, and facilities for drying, seasoning and storing lumber. The engine manufacturing shop was added in 1936.

The machine shop is maintained for the overhaul of aircraft, exclusive of engines. It is equipped with six automatic screw machines, a battery of engine lathes from 9 in. to 30 in. sizes, three flat turret lathes, horizontal drilling, boring and milling machines, and several miscellaneous drilling, grinding and milling machines. These are used for the production of bolts, nuts, screws, turnbuckles, flanges, fittings, pins and bushings required in aircraft subassemblies. Also for the fabrication and repair of landing gear, catapults, arresting devices for landplanes, parts for fuselage, wing and tail structures, and elements for operating plane control surfaces.

Much of the machine shop work is routed to the toolroom, which also produces dies, jigs and fixtures used in the sheet-metal and engine-manufacturing shops. About 60 per cent of the machines in the toolroom and machine shop are less than 10 years of age, the balance being at least 20 years old.

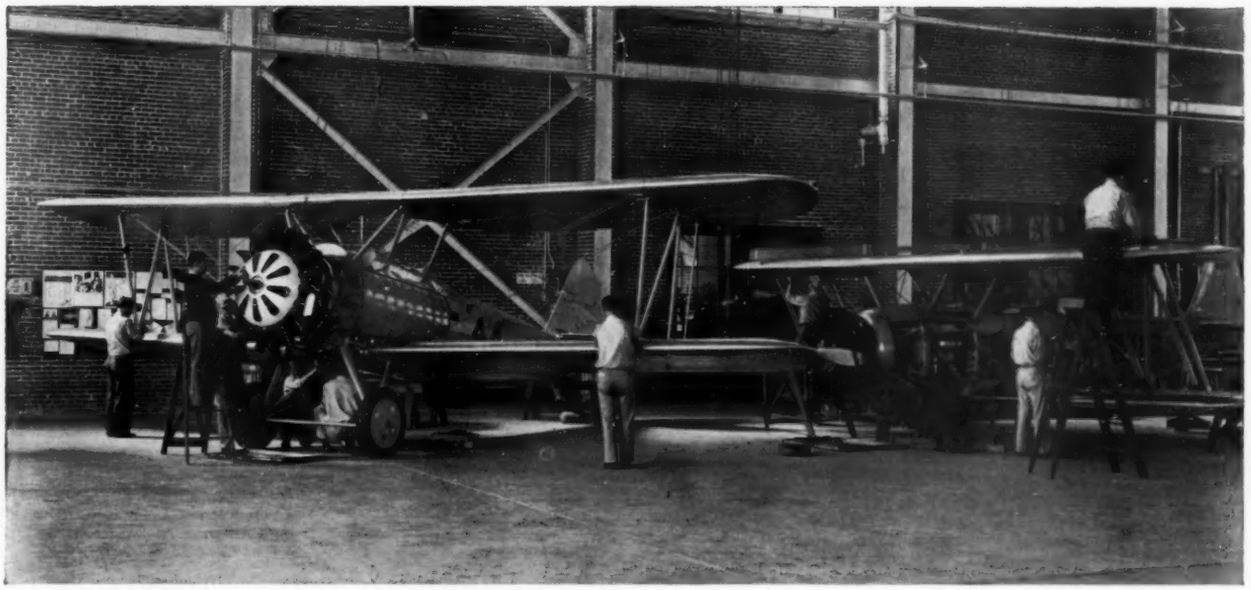
The engine manufacturing shop is departmentalized according to engine parts and material used. The departments are further subdivided according to type of work; in general, efforts are made to complete each part of the engine in its own department. The shop has its own plating, heat-treating and testing departments.

Of special interest are operations on radial-engine cylinder barrels, piston rods and cylinder heads; forgings for these parts are bought and machined at the factory. Other parts, including crankshafts, are purchased completely finished.

Rods are roughed all over to $\frac{1}{64}$ in. of finished size. The large end of master rods are first drilled, bored and faced on one side, after which they are reversed and faced on the opposite side. The pilot diameters are also finished at the same time. A 36-in. American radial and a Leland-Gifford horizontal drill are used for drilling and boring wrist pin holes. The rods are channeled on a No. 2 Milwaukee mill. Cincinnati and Kearney & Trecker mills are used for milling between the cheeks at the back end of the rod. Following these operations, the rods are heat-treated and then finished on the same machines. Knuckle-pin holes for articution rods are ground to size on No. 16 Bryant Internal grinder.

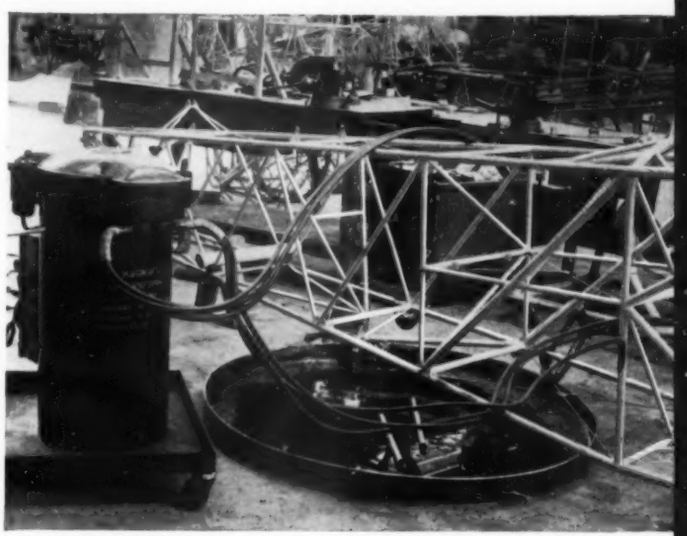
The Assembly shop is the largest building at the factory. It contains the sheet-metal, ignition, engine-repair, paint, fabric, and parachute shops in addition to having adequate floor space for the assembly of plane substructures and complete aircraft. One end of the shop is devoted to the overhaul of the few planes assigned to the factory for repair. The machines here are used in shaping metal for plane subassemblies.

A master engine rod is chucked in a No. 16 Bryant internal grinder for finishing articulating rod knuckle-pin holes



Final assembly of aircraft at the Pensacola base, which is equipped with modern buildings and equipment for the overhaul of training planes, engines and aircraft instruments

Official U. S. Navy Photographs



Magnaflux testing equipment is used for locating cracks in aircraft structures. Terminals of the apparatus are fastened to the fuselage by C clamps

PENSACOLA

IS A NAVAL TRAINING BASE

THE PENSACOLA Navy Yard has seen many changes, both in its activities and the flags under which it has existed. These include Spanish, French, English, U. S. A., C. S. A., and the State of Florida. The yard was active in shipbuilding until the demise of wooden ships, after which it became a naval base. A training school for Navy airplane pilots was established there in 1914, and today is the eastern base for training fliers and maintaining training planes. Buildings in which the planes, motors and instruments are overhauled are all of modern construction.

Among the equipment needed, and it is gratifying to note that those responsible for results are keenly alive as to new methods, are motor-driven lathes, a modern boring mill, universal tool grinder, gas furnaces, another turret lathe, a single point boring machine, a spot welder and a drop press. Broaching is also being considered but the large variety of parts and the small quantity of each, makes selection of both machine and method quite a problem.

Single-row radial engines predominate largely on training planes. This type of engine uses a single-throw crankshaft. The crankpin is ground in an old lathe fitted with a face plate fixture. This is a bronze sleeve, so mounted on the face plate as to give the proper throw to the crank. A plug with a center is put in the hollow end of the crankpin, the tailstock center pushed into place and the pin is ready to be ground. The grinding wheel has to be small to clear the counterweight and a substantial tool post grinder, with a guard over the wheel, does the trick.

After the engines are assembled in the usual way, on revolving stands, they are pumped full of oil at 100 lb. pressure to insure that all the oil lines and passages are clear.

Another precautionary measure, as well as a salvage operation, employed is that of washing old grease and foreign matter out of the bearings with kerosene under pressure. After washing, the bearing is again filled with the proper grease in an ingenious holder, the grease being forced in with an Alemite gun. Some of these bearings are a trifle small on the outer diameter when they come to be reassembled. To avoid discarding them they are put between protecting flanges and chromium plated on the outside. They are then ground to the proper size for the place in which they are to fit.

An application of a comparatively new grinding tool is a 100,000 r.p.m. grinder used to start holes through the "case" of hardened steel rings. The ring is clamped in a fixture which holds the grinder. This bushing for this purpose guides a plain part of the spindle back of the grinding wheel. Careful usage soon cuts through the case and the hole is finished by drilling.

SAN DIEGO—THE NAVY'S LARGEST AIR BASE

Work at the San Diego air base includes all types of maintenance on all types of planes used by the Navy. Increasing use of all-metal planes has emphasized the importance of the machine shop at this base

WORLD'S GREATEST naval air base is the title often given the U. S. Naval Air Station on North Island, San Diego, Calif. In number of planes based and maintained, and in storage, service and maintenance facilities, North Island probably outranks any naval air base anywhere.

One of four major naval air stations, it is the only major Navy air base on the Pacific Coast. A second large base is now being built at Alameda, Calif., but until its completion the Navy looks to North Island for maintenance of all its Pacific Coast aircraft, whether fleet or shore based. To a considerable extent the Naval air stations at Sand Point, Seattle and in Hawaii depend on North Island for supplies and special service.

A Hopping-Off Point

North Island has shops and hangars spread over an area more than a mile square. Over a thousand men, both civilian and Navy personnel, are employed. From this base have started some of the more notable naval flights, such as the mass delivery of Consolidated PBY bombers over the Pacific non-stop to Hawaii.

North Island has been termed the "cradle of military aviation" in the United States. Its history has been romantic since its discovery by Cabrillo in 1542. Aviation on the Island dates back to 1910, when Glenn Curtiss founded a civilian flying school there because of the unobstructed terrain, exceptionally fine flying weather, and uniformity of wind direction and velocity. Recognizing these advantages, the Army established an aviation school there in 1912.

Following America's entrance into the war, a naval air station was opened in November, 1917. The next year North Island was divided between the Army and Navy, the Army being given 725 acres on the west side of the island, which was then named Rockwell Field, and the U. S. Naval Air Station being allocated 750 acres to the east of Rockwell Field. By the time of the armistice the naval air station had grown to major proportions.

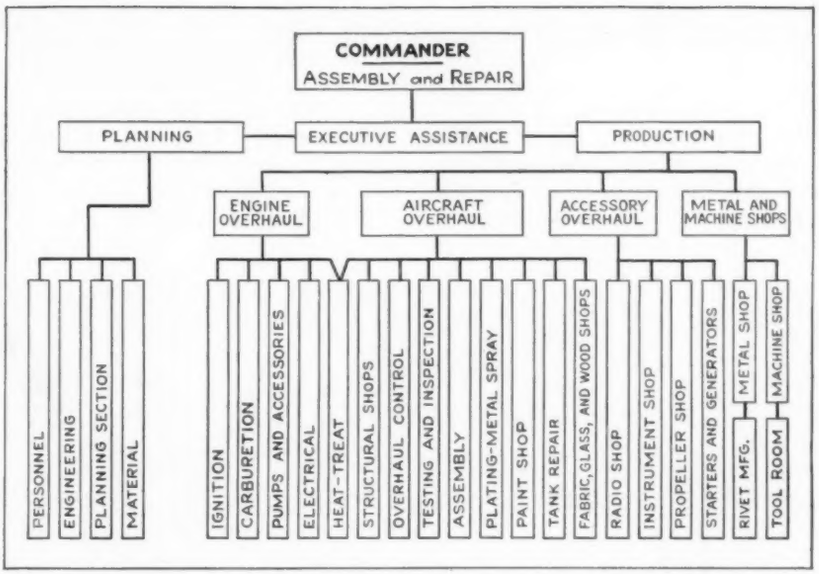
Recently Army operations conducted at Rockwell Field have been transferred to the Army air depot at Sacramento, Calif., and all of North Island has been taken over by the naval air station. Even with the addition of Rockwell Field, the Navy has had to undertake a major expansion program to keep abreast of the rapid growth of the fleet's air force.

At present a substantial building program is in progress, primarily providing for additional shop facilities. New buildings will exceed 100,000 sq.ft. of floor area. Altogether, the government's investment in equipment for maintenance at North Island will be over $1,000,000.

Connected With Mainland

North Island is not actually an island. With an area of more than 1,500 acres, it is situated at the northern tip of a long sand peninsula which bounds San Diego Bay on the ocean side. South of it and connected with it by a narrow strip of sand is Coronado Island, which is in turn connected with the mainland by a slim sand spit extending on the south to the mainland proper. The city of San Diego is almost directly east of North Island, on the mainland side of the harbor.

Work embraces all classes of maintenance on all types of fleet planes, from tiny single-seater fighters to huge Consolidated PBY patrol bomber flying boats which span the



Maintenance operations on the Navy's planes at San Diego are organized as shown in this chart. Groups of carefully selected and trained men handle the work in each of the shops. For the most part, each is a specialist in the work to which he is assigned

ocean in a single hop. The trend toward metal planes has emphasized the importance of the machine shop and of metal working tools in general at this base.

In many respects maintenance work is more complex than original aircraft manufacture, for disassembly, cleaning and inspection must be done before maintenance and repair can be started. Complete manufacture of parts or assemblies is frequently necessary, though a full stock of parts is normally carried.

Activities Subdivided

Maintenance is divided into four major jobs—engine overhaul, aircraft overhaul, accessory overhaul, and machine and metal shops. Each activity is broken down into various special divisions. Engine overhaul shops perform operations on ignition, carburetion, pumps and engine accessories, and spark plugs.

Aircraft overhaul is the most complex activity, including dis-assembly and primary inspection, degreasing and cleaning, magnaflux and detailed inspection, plating, anodizing, metal spraying, painting, tank repair, fabric shop, wood shop, glass shop, decalcomania studio, and final assembly.

Under accessory maintenance are the radio shop, electrical shop for starters and generators, instrument shop, and propeller shop. Metal and machine shops are fairly self-contained. The only subdivision in the metal shop is the special rivet manufacturing department. The machine shop has a tool room in addition to a special screw machine department for production runs of special screws and studs.

A vital function of maintenance work is the chemical and physical laboratory where tests are constantly being made. Another important department is the photo laboratory, where complete photographic records are made and kept of every part, every operation, and every defect or flaw found in connection with maintenance.

Work flows easily through the shops by proper spacing of equipment and handling of parts and assemblies. Overhead cranes or trolleyways are provided in almost all shop buildings. Material is handled between shops by one-ton trucks powered by Ford engines. Within the shops are special racks for engines, aircraft wings and fuselages, and other major assemblies being overhauled.

When an airplane is damaged or has been in service eighteen months without overhaul, it goes to the maintenance shop to be torn down. Most major engine overhauls are made after 500 hours of service. However, the time factor varies with the make and power of engines.

Airplanes are inspected as they are dis-assembled and instructions given as to maintenance procedure. All aircraft and parts are routed through the shops by a dispatching station. With each fuselage, wing, or other major assembly goes a record sheet listing operations to be performed, as well as inspectors' notations as the work is completed and approved. Wired to each small part removed from any assembly during maintenance are embossed metal identification tags.

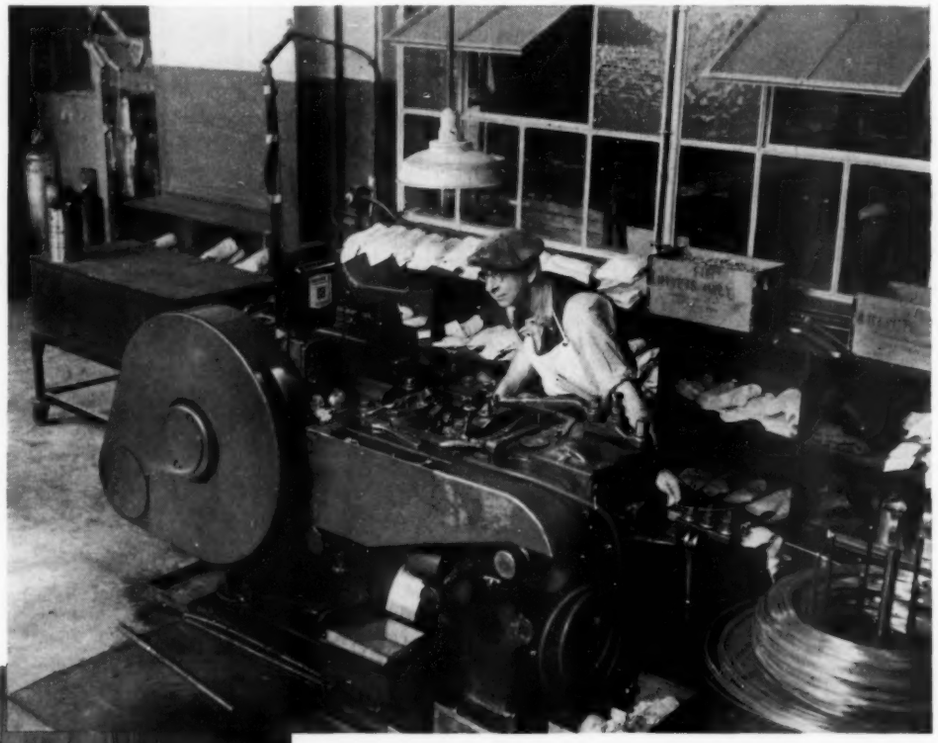
Wings and other surfaces are covered in the fabric shop and are wrapped with thin aluminum foil to protect the metal parts against corrosion. The dope and paint shops are flame-proofed and provided with power exhaust systems to eliminate fumes. All fuel and oil tanks are sent through a separate shop during overhaul.

When major repairs are made on a fuselage, the facts are entered in

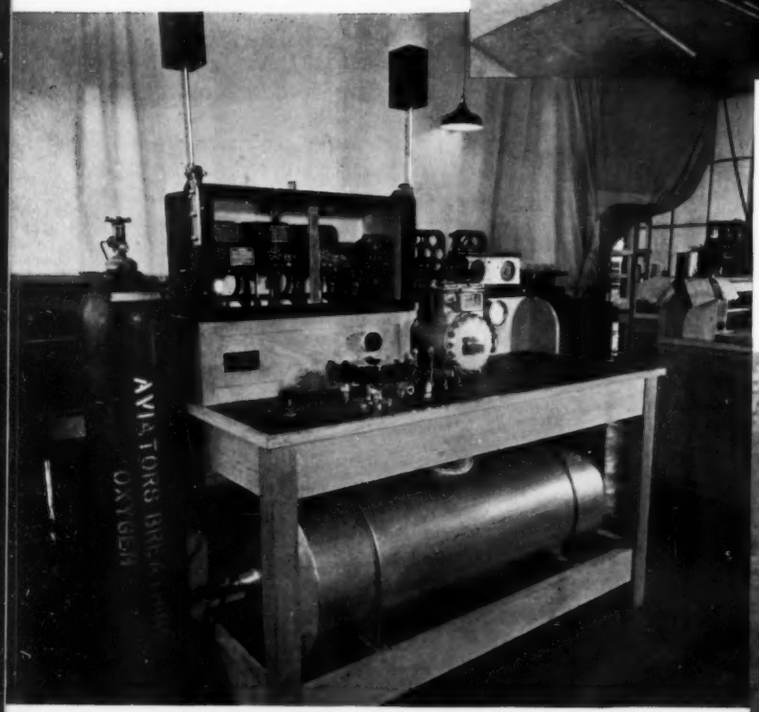
Portable fuselage trestles and work benches speed up plane overhaul and repair operations

the ship's log which accompanies each plane throughout its life. Since wing panels are interchangeable, permanent metal plates are attached to each panel at the time of overhaul, with information stamped on the metal as to the repairs made.

The metal shop is devoted mostly to sheet metal work, though welding of tubing is done. In addition to actual aircraft repair, miscellaneous work and a considerable amount of experimental manufacture in connection with sub-assemblies is undertaken. Work in the machine shop is divided about evenly between general machine work of a miscellaneous nature and maintenance work on aircraft and engine parts. Inasmuch as most parts are replaced from stock where necessary, the machine shop performs only unusual or special jobs. Typical machine shop maintenance work consists largely of machine operations on aircraft engine pistons, aircraft fittings of various types, and aircraft landing gear parts.

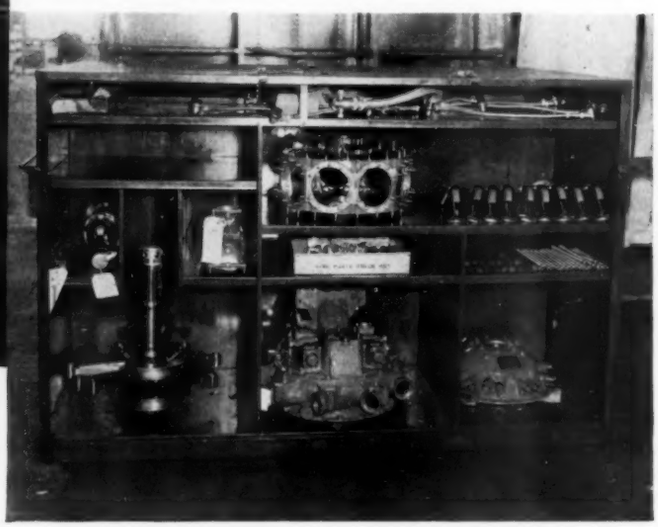


Such a wide variety of rivets are required that it is not economical to maintain a full stock. Hence, most of the rivets used at San Diego are made on this machine



The instrument shop is in an air conditioned room maintained at constant temperature. Shown is the special oxygen regulator test equipment

Parts for engines being overhauled are cleaned, inspected and then placed on portable racks. Each rack is designed to hold the parts of a single engine. Tags indicate operations to be performed and inspectors approval



Faulty Grinding and Its Correction—II

By H. J. WILLS
Sales Engineer, The Carborundum Company

INACCURACIES IN WORK

Defect	*Cause*	*Methods of Correction*
Work out of round.....	Uneven pressure of driving points	Provide cushion between points and work; place points equidistant from work axis
	Driving points not parallel with axis	True faceplate and pins
Work out of parallel or tapered...	Faulty grinding machine....	Correct worn ways and setting of tail or head stocks; tighten spindle bearings
	Improper dressing.....	Make sure machine conditions are same at point of dressing as at point of grinding
	Improper operation.....	Do not permit wheel to pass off work at end of traverse, which causes taper at work ends; decrease pressure, which springs work; use harder wheel
	Expansion of work.....	Reduce temperature of work by using more coolant and lighter cuts; keep work out of drafts

CHECKING OF WORK

Work shows check marks.....	Improper wheel manipulation	Prevent wheel from acting too hard; do not force wheel into work; use larger and more even flow of coolant; prevent belt slippage

BURNING OF WORK

Work shows discoloration.....	Improper wheel.....	Use softer wheel or manipulate to get softer effect; prevent glazing and loading; use more coolant; prevent chatter
	Faulty operation.....	Bring wheel to work more gradually, use less in-feed; eliminate belt or wheel slippage; prevent possible stoppage of work

INTERNAL GRINDING

Source of Fault	*Methods of Correction*
Spindles	High speed internal grinder spindles of the ball-bearing type are very sensitive to slight faults. Because of their special construction and special races and balls, it is best for repairs to be made only by the spindle manufacturer. Lubrication of spindles is of great importance. Use only the lubricants recommended by the spindle manufacturer.
Machine Play	Since both wheel and work heads are usually of the swivelling type, they must be checked for play and anchorage.
Belts	Internal grinder belts, with their high speed, short centers and small diameter pulleys, must be frequently checked for oiliness, wear and tightness, as slippage is an especially serious fault.
Dressing	Faulty dressing is one of the most frequent causes of faulty grinding, short wheel life and poor finishes. Keep careful watch to prevent wear in the tool bracket bearings. Because of the small size of the wheels used in internal grinding, it is essential that the diamond be of proper size and maintained with a sharp point. If abrasive sticks are used, take care that the grit is not pressed into the wheel pores.
Wheel Characteristics	Most internal wheels are inefficient because of the extreme change in wheel diameter with no corresponding change in spindle speed. Often it is possible to increase wheel life by using a wheel of greater width. Due to the limitations of chip clearance in internal grinding, it is necessary to use coarse, open wheels.
Unwanted Tapers in Straight Holes	Be sure wheel head is parallel with table travel; use softer wheel or manipulate for softer effect; correct work or wheel head angling; prevent gumminess of coolant; use lighter in-feed; be sure wheel is dressed parallel to table travel; use harder wheel.
Bell-Mouthing	Reduce over-travel of wheel from hole.
Faulty Taper	Be sure wheel is parallel to desired taper; eliminate back-lash in headstock; harden or soften wheel effect.

WHEEL BREAKAGE

Radial Break, three or more pieces	Reduce wheel speed to rated speed. Correct improper mounting such as: lack of blotters or pads, tight flanges, uneven flange pressure, dirt between flanges and wheel. Prevent overheating due to lack of coolant, or excessive wheel pressure on work. Do not allow wheel to become wedged on work.
Radial Break, two pieces	Prevent excessive side strain.
Irregular Break	Do not allow wheel to become wedged on work; prevent hammering blows on wheel; don't use defective wheels or wheels that have been damaged in handling; examine wheel before using.
General	Do not use a wheel that is too tight on the arbor. If that is the trouble wheel will break when started. Prevent excessive hammering action of wheel. Familiarize yourself with the provisions of the safety code governing use of grinding wheels—*and observe the rules.*

IDEAS FROM PRACTICAL MEN

Notching Tool

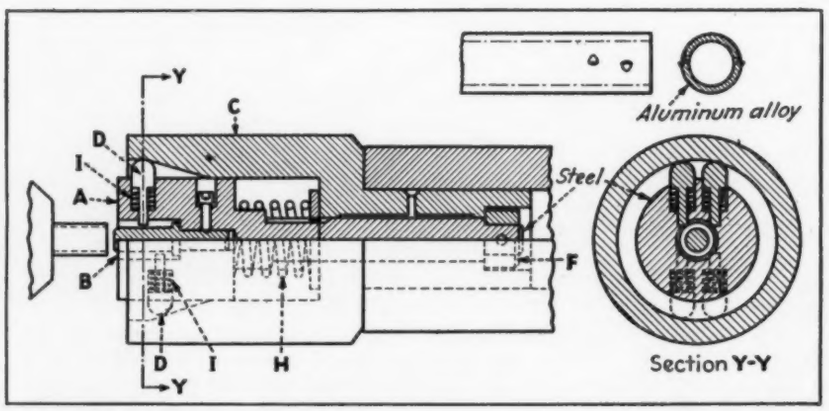
By W. M. HALLIDAY
Peterborough, Northants, England

Some short aluminum-alloy tubes were to have special zinc-base parts die-cast on one end. While advantage was taken of the shrinkage grip when the castings cooled, it was thought advisable to notch the tubes in four places to further anchor the castings to prevent them from turning on the tubes. At first the notching was done in a bench press, but it was thought possible to do it in the turret lathe where the tubes were cut off from long lengths of tubing held in a collet chuck.

Accordingly, the tool illustrated was designed to be held in the turret. Essentially it consists of the body *A*; the horn *B*; the sleeve *C*; the four notching punches *D*; the collar *F*; the spring *H*; and the springs *I* on the notching punches.

In operation, the turret is advanced until the horn engages the projecting end of the tubing and the end of the body of the tool is in contact with the cap of the chuck. The friction caused by this contact causes the body to revolve in unison with the spindle. Further advance of the turret causes the sleeve to slide forward on the body, compressing spring *H* and causing the conical bore at the front of the sleeve to force the notching punches inwardly and notch the tube. Backward movement of the turret first withdraws the sleeve and releases the pressure of its conical bore from the notching punches, permitting their springs to force them outwardly clear of the tube. As the backward movement continues, a shoulder in the bore of the sleeve contacts collar *F* on the shank of the body and both sleeve and body travel backward in unison with the backward movement of the turret. The length of tubing is then fed forward against a stop ready for the short piece to be cut off.

Use of this tool made a very appreciable increase in production, due to the elimination of notching in a separate operation. Since a tool of this type has other similar applications, such as stamping, dimpling and otherwise marking bushings, rods, etc., it will no doubt be of interest to tool designers.

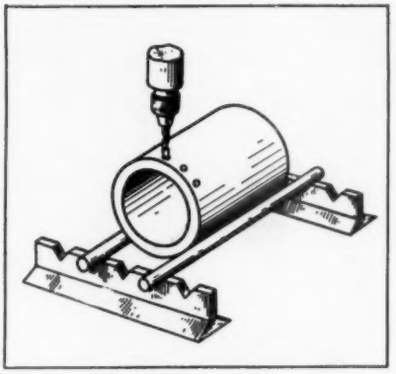


Notching aluminum-alloy tubes to anchor special parts of zinc-base die-cast on the ends was done by this tool in a turret lathe

Fixture for Holding Large Cylindrical Work

By CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

One of the simplest and most useful devices for holding cylindrical work of large diameter that should appeal to machinists is shown in the accompanying sketch. It consists of two pieces of standard I-beam section having one flange cut off from each and having a series of V-notches



One flange is cut off and V-notches are cut in the tops of the webs. Two round bars laid in the V-notches complete the fixture

cut in the tops of the webs. These two pieces in conjunction with two bars of round stock laid in the V-notches make a fixture that has a wide range for holding work of large diameter for drilling, welding and assembly work.

We have several of these fixtures around the shop and have found them very convenient for holding work of such large diameter that the conventional V-blocks would be prohibitive because of their excessive size and weight.

Toolholders and Toolposts

By MARTIN H. BALL

The boring mill toolholder illustrated in Fig. 1 was made to give the toolbit top rake without being ground on the top surface and, at the same time, avoid the waste incurred by grinding and regrinding to retain the proper rake which will eventually weaken it at point *A* as indicated in the toolbit *B*. After many grindings the dimension *C* may be so reduced that the cutting end will break off in use, making it necessary to renew it by grinding farther back. If, however, the point of the toolbit is tilted upward by the toolholder, grinding can be progressively done on the side and the end, as indicated by the toolbit at *D*. Therefore, grinding on the top is not necessary except it be to secure and retain a smooth surface

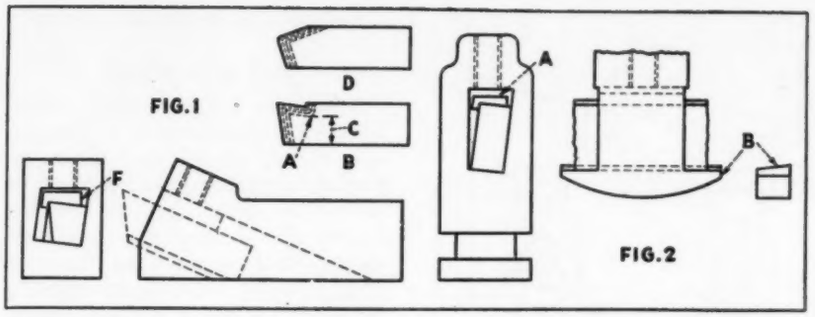


Fig. 1—Grinding top rake on toolbits can be avoided where toolholders tilt the points upward. Fig. 2—Tilting the toolholder sidewise gives side rake to the toolbit

that will permit the chips to slide off easily.

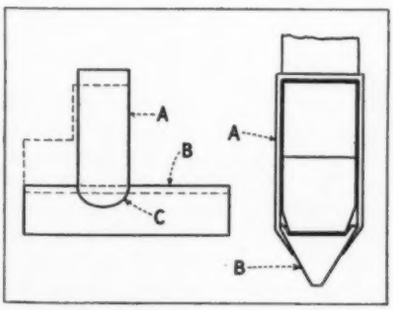
To give side rake to the toolbit, the hole in the holder is at an angle and the toolbit is firmly held on its seat and on its side in the direction of the thrust from the feed by pressure of the holding screw on the wedge-shaped angle piece *F* so that it cannot move under pressure of either cut or feed.

The lathe toolpost illustrated in Fig. 2 was made to properly locate and hold a standard toolholder to give side rake to the toolbit by holding the holder against the angular side of the slot in the direction of thrust from the feed by pressure of the screw on the wedge-shaped angle piece *A* and down on the angular top surface of the rocker *B* which rests in the usual saucer-shaped collar.

Auxiliary Chuck Jaws

By ERNEST E. BOLINGER
Boise-Fayette Lumber Company

Since our lathe chucks would not hold work smaller than ¾ in. in diameter, and we had a lot of work smaller than that to be chucked, I made the auxiliary jaws illustrated.



Strap iron bent to a U-shape, welded to triangular steel pieces and slipped over the inner ends and the second steps of the chuck jaws enabled smaller work to be held

Pieces of ⅛x1 in. strap iron *A* were bent into a U-shape and the ends were welded to the triangular steel pieces *B* at *C*. The assemblies were then slipped over the inner ends and the second steps of the chuck jaws, enabling the auxiliary jaws to be closed on smaller work. I made a set for each of the chucks on our 24 and 36-in. lathes and they have been in use for about six years.

Since they are very satisfactory and have helped us out of many tight places, I am passing the idea along in hope that it will be of help to someone faced with like difficulty.

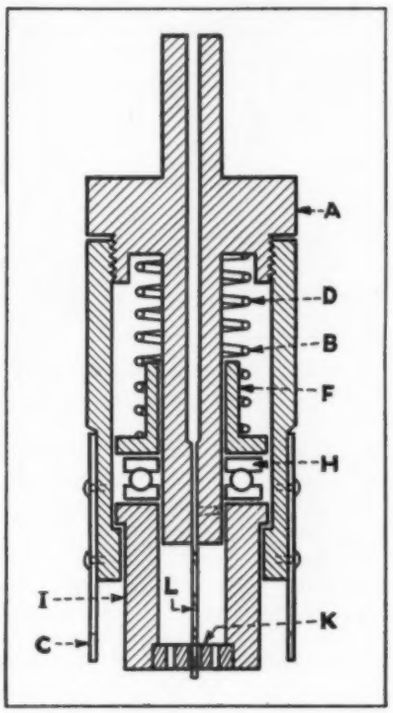
Trepanning Tool

By K. N. BANTHIN

To reduce the possible metallic contamination of a hot (600 deg. F.) granular refractory product, the material is removed from the retorts by scrapers consisting of wooden buttons from 2 in. to 2½ in. in diameter and held on a round stick by a single nail. Formerly the buttons were sawed out on a bandsaw from boards ½ in. thick, first drilling the nail holes. About 500 buttons were required per day and the method of production was both costly and fatiguing for the operator.

To increase production without undue fatigue to the operator, the trepanning tool illustrated was designed to be used in the drill press which was rigged so that the spindle was normally held up by a spring and lowered by a pedal under control of the operator, leaving his hands free to handle the boards. Essentially it consists of the body *A* on which is screwed the sleeve *B*; the cutters *C*; the spring *D*; the spring retainer *F*; the ball bearing *H*; the ejector *I*; the hardened plate *K* for guiding the drill; and the drill *L* for drilling the nail hole.

In operation, as the spindle is lowered the drill drills the nail hole. Further and continued downward movement of the spindle brings the cutters into action, the ejector sliding upward against pressure of the spring. When the cutters have passed entirely through the board the spindle



Used in a drill press, this tool trepans the buttons and supersedes the costly method of sawing them out on a bandsaw, besides doing better work.

is raised and the ejector pushes out the finished button.

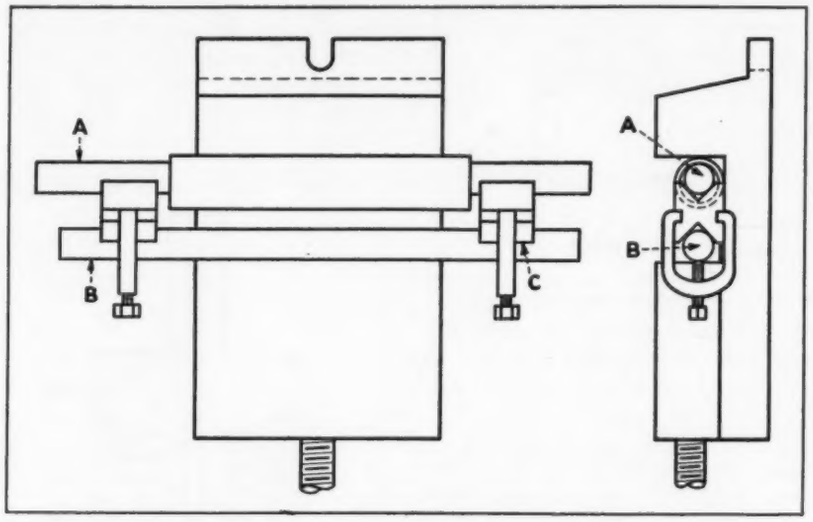
Besides greater production, the tool produced buttons with smoother edges which offered less opportunity for them to ignite and gave them longer life.

Slitting Thin Tubes

By H. MOORE
Kirkstall, Leeds, England

Recently I had to saw a lengthwise slit in some brass tubes, the work being done in a milling machine. The tubes could not be held in the machine vise direct because the pressure of holding would cause them to close in at the slit, loosening them in the vise and binding the saw. To overcome that condition I used the somewhat original set-up illustrated.

A bar *A*, much smaller and somewhat longer than the tube was passed through the bore, extending from the tube at each end. Then the bar *B* was clamped to a pair of V-blocks at *C* with yoke clamps. The whole as-



This set-up permitted the tubes to be held in the vise without danger of closing in at the slot behind the saw

sembly was put in the vise and when the movable jaw was closed the tube was held by pinching the wall between bar *A* and the stationary jaw through pressure of the movable jaw on bar *B* and the V-blocks. So held, the tube was free from any tendency to close in as the slit was sawed.

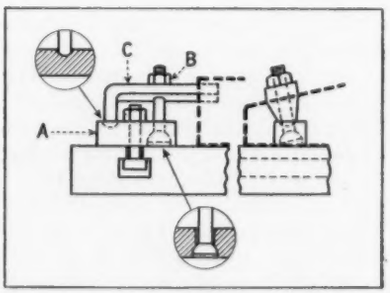
To remove the slitted tube it was necessary only to open the vise far enough to slide the tube off of bar *A* and past the V-blocks, when another tube could be put in its place.

Compensating Clamp

By F. DOUGHTY
Shipley, Yorkshire, England

Recently I had to clamp some work having an angular surface to the machine table where a normal clamp could not be used, so I made the compensating clamp illustrated.

Essentially it consists of the block *A*, the clamping bolt *B*, and the clamp *C*. The block is attached to the machine table by the usual bolt in one



A hemispherical head on the clamping bolt bears in a hemispherical seat in the block, permitting the clamp to accommodate itself to an angular clamping surface

of the T-slots. The hole in the block for the clamping bolt has a hemispherical recess in which the hemispherical end of the bolt bears. The hole having, of course, a reasonable amount of clearance for the bolt so that it will not be restricted in a moderate angular movement. On top of the block and directly under the heel of the clamp is a recess which permits the clamp to rock. The arrangement of the device permits the clamp to accommodate itself to a certain amount of angularity in the clamping surface of the work.

Reversing an Old Custom

By FRED A. PATTERSON

Recently I had to fit some 8-in. diameter bronze bushings tightly into holes bored in steel castings. Heating the castings to expand them was out of the question because I feared they would lose some of the accuracy of their machined surfaces by distortion. I made a sleeve a little longer and 2 in. larger in diameter than the bushings out of 18-gage sheet iron. A bushing was put in the sleeve and the space around it was packed with dry ice. After about ten minutes the bushing was taken out and it had shrunk enough to be slipped into place. When the bushing expanded by coming to room temperature it was tight.

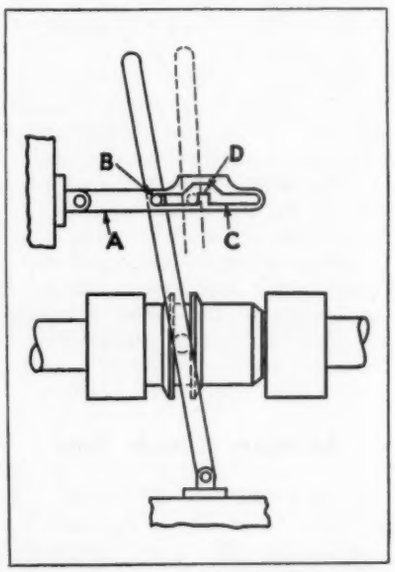
This method causes no distortion and there is no delay in waiting for the castings to cool. I am glad to pass this method along to readers of *American Machinist* as an improvement over the slow and costly way of heating and expanding the parts into which bushings are to be tightly fitted.

Safety Declutching Latch

By L. KASPER

In a wire-straightening machine the wire is drawn from a free-running reel by another reel driven by a shaft. At times it is necessary to reverse the order, the free reel becoming the driving reel, which is accomplished by a double clutch on driving shafts running in opposite directions. When it becomes necessary to stop the machine quickly, the wire was sometimes broken because the operator shifted the clutch spool past the neutral point, engaging the reverse shaft.

To obviate that condition the safety latch shown at *A* was pivoted to a stationary part of the machine. When the clutch lever is shifted slowly, the pin *B* in the lever slides along the cam slot *C*. As the pin



Shifting the clutch lever slowly will reverse the motion of the machine. Shifting it quickly will stop the machine without danger of reversing its motion

nears the square obstruction *D* in the middle of the cam slot, the latch drops by gravity and permits the pin to pass over the obstruction so that shifting can be continued until the pin strikes the end of the slot, reversing the motion of the machine. However, when the lever is shifted quickly, the pin strikes the obstruction before the latch has time to drop, arresting further movement of the lever and keeping the clutch spool in the neutral position, thus stopping the machine without danger of reversing it and breaking the wire.

Slash Spending

IN WHITE PLAINS, N. Y., the other night a State Senator asked a large group of taxpayers seeking reductions in state expenditures the rhetorical question, "You wouldn't have the courts and government departments closed for lack of funds would you?" He was disconcerted when the audience as one voice spoke out, "Yes!"

That may be taken as an indication of the temper of the people. On all sides is evidence that the factory worker, as well as the business executive and the property owner, is worried by the increasing amount of money going to the support of government rather than into purchases of goods which make more jobs in private industry.

National polls have revealed deep concern over the mounting public debt. Congress has broken away from the administration and reduced W.P.A. allotments. New York taxpayers recently organized a "march on Albany" to seek a paring of the State budget.

The growing portion of the national income absorbed by taxes is something to make one stop and think. Back in 1926 it was 11.7 per cent, according to the National Industrial Conference Board. By 1936 it had expanded to 16.5 per cent. That meant that out of a national yearly income of $65,000,000,000, the people would pay $10,725,000,000 to local, state and federal governments.

Funds extracted by the federal government from the people have more than doubled in the last ten years. In 1928 they were 4.2 per cent of the national income. Last year they were 9.4 per cent. State expenditures have gone up proportionately. Even local taxes have taken an unpleasant turn.

Bear in mind the fact that these figures pertain only to tax collections. They do not include deficit financing to cover the difference between income and outgo.

What would *real* reductions in government expenses and in taxation accomplish? Plenty. They would result in more efficient operation by government. They would hearten industry by lifting from its shoulders some of the taxes which now adds to its problems and which make it increasingly hard to earn a reasonable profit.

Above all, slashes in public spending would be a move in the direction of renewing the people's waning faith in the financial stability of their own government.

Burnham Finney

GAGING BUSINESS

War scares, new labor troubles, and the fact that promised New Deal business "appeasement" has not materialized all contribute to a more depressed business sentiment.

Industrial business right now is facing a real test. Since last summer it has shown a steady upward trend, not so fast as some sales managers wished, but still a good gradual growth. The March Machine Tool Index jumped to 185.4, the highest level for eighteen months. Business still seems to want to move ahead but to do so it must pass a series of hurdles any one of which may throw it off its stride.

New Deal "appeasement" which was promised to go beyond the verbal stage has stopped right there; and the stopping place appears to be the White House. Labor troubles have reappeared with the outbreak in the soft coal fields. Several industrial centers are jittery for fear that this symptom may materialize in a new rash. The foreign situation has not been conducive to quiet nerves with the man on the street giving greater attention to geography than he ever did at school; and the corallary to this uncertainty, a stock market break, has not helped sentiment.

Government orders, educational and otherwise, so widely heralded as a new stimulus for industry, have not materialized in sufficient volume to have a strong effect. Foreign sales have tended to fall off. The result has been a spotty business picture, with some sections still pushing ahead while others feel the pinch. An encouraging indication is the underlying vitality in the face of so much uncertainty.

NEW ENGLAND—This is a bright spot. Bethlehem Shipbuilding, at Fore River, has ordered about $250,000 worth of turret lathes and planers. A Rhode Island manufacturer got a milling machine order from the navy, exceeding $10,000. The U. S. Maritime Commission is to spend $90,000 for two Gantry cranes at the Boston Army base terminal. Textile machinery makers are for the first time in many months showing a real interest in machine tools. All in all, April in Yankeeland is off to a good start.

NEW YORK—In the shadow of Wall Street the metropolitan area is doing pretty well. Some good business has been placed during April and more is pending. Aircraft makers are among the active buyers. Government orders are coming in steadily.

PHILADELPHIA—Buying in eastern Pennsylvania has slowed up. Other than small individual orders, little business is being placed, with the coal strike blamed as the repressive influence. Some action on government inquiries is looked for within the next 60 days.

PITTSBURGH—Labor troubles give concern here, with the C.I.O. losing influence and local leaders using sniping tactics. As a result, orders and inquiries have dwindled during the past ten days.

CLEVELAND—Increased domestic sales and scattered foreign orders gave Cleveland a good March. Some factories are now operating in advance of sales in anticipation of a gradual improvement. Although the export trend has been down for the past two months, large proposals in England, France and Japan lead to a hope for its revival.

CINCINNATI—April in Cincinnati is reported to be below last month. There is a wider range of customers, but orders are definitely smaller. Armament orders are expected but to date have not materialized on any considerable scale.

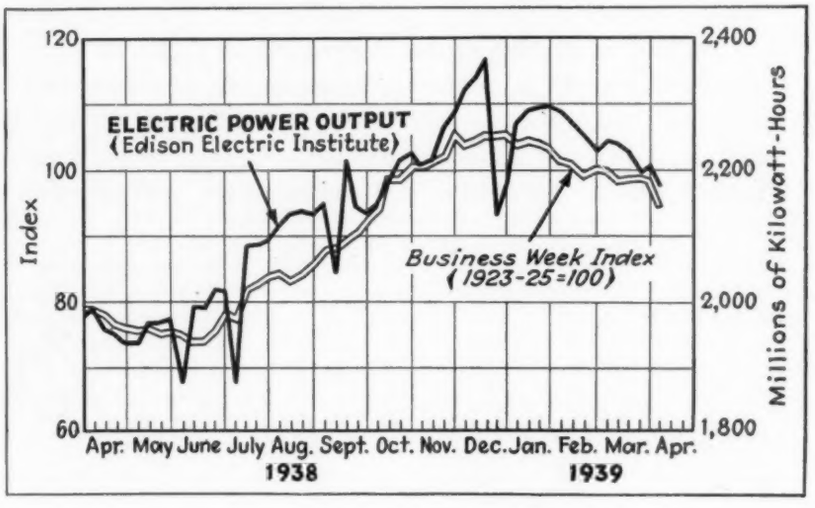
DETROIT—War scares and lower stock prices have dampened sentiment in the auto industry. New model programs are about cleaned up. General Motors has not placed many orders on its $2,000,000 program for its new transmission plant. Some die work is being let with about $1,000,000 worth being placed by Fisher Body. Interest is being displayed in industrial baking ovens.

CHICAGO—Activity here has swung from steady to spotty. With less upsetting news the feeling is that business would resume its recent strong tone. The tractor industry shows signs of fair activity. Deere, Oliver and the Moline plant of J. I. Case are running close to capacity. Other implement plants are slow. The Harvester Farmall plant, at Rock Island, will not get into operation for several weeks because of change-overs to take care of the new 20- and 30-hp. models. Caterpillar is going strong at Peoria. Last week Chicago Flexible Shaft started a new three-story building, partly machine shop and partly stores.

MILWAUKEE—This is another good spot. Orders are coming in at a rate that indicates April may go ahead of March. Current conditions have a healthy look.

POWER CONSUMPTION VS. GENERAL BUSINESS

The Spring slackening of industrial activities is reflected both in the use of electric power and in the drooping business curve



NEWS OF THE INDUSTRY

STRESS DEFENSE IMPORTANCE OF METAL-WORKING INDUSTRY

NEW YORK—The ever-increasing importance of the metal-working industry as a major element in national defense, both in peace and in war, was stressed by the Hon. Louis Johnson, Acting Secretary of War, at the National Industrial Preparedness Dinner of the American Conference on National Defense held here April 5. His remarks concerning naval operations were amplified by Rear Admiral Clark H. Woodward, U. S. Navy Commandant, Third Naval District, in discussing "Industry's Relation to Naval Preparedness."

"Of the 10,000 plants allocated for munitions purposes in this country, more than 4,000 of them are located in the area that extends from Boston to Wilmington and west to Pittsburgh. Pennsylvania has 1,431 allocated plants. New York has 1,101, Massachusetts has 711, New Jersey has 42, Connecticut has 349, Rhode Island has 148 and Delaware has 29.

"This small territorial belt that I have designated is the life line of America. More than 60 per cent of our war needs for munitions will have to be manufactured in this congested area."

Amplifying Assistant Secretary Johnson's remarks, Rear Admiral Woodward, insisting that "the navy stands or falls by its strength at the time the war breaks," outlined the urgent necessity for the rehabilitation of Navy yards and private shipbuilding facilities. Although several millions of dollars have been spent to this end in the last few years, "much 20-year old equipment and obsolete machine tools still exist due to the paltry appropriations made prior to 1933.

"Because of the greatly expanded ship-building operations, both in the Navy and merchant marine, this shortage of machinery and modern equipment is severely felt at present, and the need for them grows more urgent as time passes. Nevertheless, due to this enlarged program the consequent necessary rehabilitation of Navy yards and private ship-building plants will make us more ready to meet any future emergency. By the time the present program reaches its peak—about 1942—the number of employees in Navy yards will probably exceed those engaged during the World War."

MACHINE TOOL INDEX RISES

CLEVELAND—The index of machine tool orders, compiled monthly by the National Machine Tool Builders Association, climbed 18 points to reach 185.4 for March. This figure compares with 107.0 for the corresponding month of 1938, when the trend was still strongly downward.

The three months moving average also registered a considerable increase, rising almost 10 points to 167.8.

AUTO PRODUCTION RATE HIGHER

DETROIT—Total factory sales of cars and trucks in the first quarter were 1,055,787, a gain of 58 per cent over the same period in 1938, reports the Automobile Manufacturers Association.

Reports of sales in the last ten days of March show that many individual companies experienced a strong spring bulge, belieing reports that the sales curve was due for a tumble earlier than usual.

SEE ONLY WASTED TIME, MONEY IN AUTOMOBILE UNION STRUGGLE

DETROIT—Dual unionism in the United Automobile Workers will give management plenty of headaches in the months to come, in the opinion of observers connected with automobile industry. They are particularly disturbed by reports that control of the executive board elected by the C.I.O.-U.A.W. faction at Cleveland passed into the hands of the Communist Party. Twelve out of nineteen board members are identified with the left-wing bloc, and contain elements that Homer Martin says wrecked the union.

Martin's forces are pointing to an alleged $300,000 expenditure by the opposition for organizing purposes between Jan. 20 and the Cleveland convention, March 27. That amount, plus that organization's expenditures is said to be hardly worth the candle. In other words, Lewis still must contend with the fractious elements said to be tied in with the Communists. And Messrs. Hillman and Murray did not get what they were after—a union that could easily be controlled.

Basic Industry—*Visitors to the New York World's Fair this summer will be able to see in miniature the many steps in the production of steel, without which there would be virtually no metal-working industry. Here a model maker puts finishing touches on the charging side of an open hearth furnace in one of the dioramas of the United States Steel Corp.*

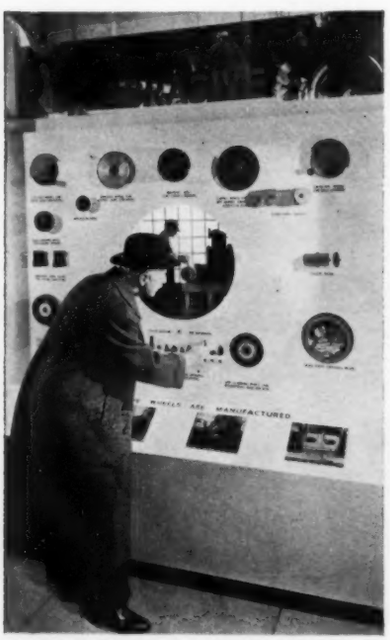
SEES CONTINUAL IMPROVEMENT IN SHIPBUILDING EMPLOYMENT

NEW YORK—A 50 per cent increase in shipyard employment by 1940, as a result of the increasing activity of American shipbuilding, has been predicted by H. Gerrish Smith, president National Council of American Shipbuilders.

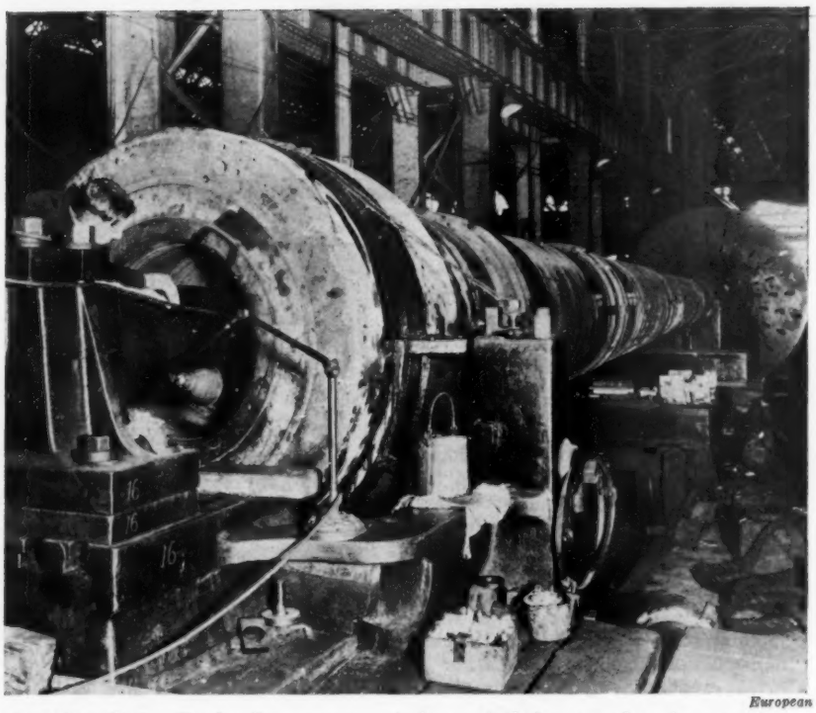
Approximately 80,000 men are employed in American shipyards today, Mr. Smith estimates, with about an equal number working in industries dependent upon ship construction. The recently expanded naval program and the plans of the Maritime Commission for replacing fifty ships a year should bring the total number of workers to 240,000 by the end of 1940. The peak is expected to level off around that figure in the following six years or so.

PLAN PREFABRICATED HOUSES

BIRMINGHAM—Machinery is being installed in the Fairfield works of the Tennessee Coal, Iron & Railroad Co. for the mass production of steel sections of prefabricated steel houses. Robert Gregg, president, asserted that T.C.I. did not plan to become active in the construction or retail sale of the units, but merely intended to supply the prefabricated material to contractors, builders and other large-volume purchasers.



The Old Grind—*Gives way to the new as shown by this Bakelite exhibit at the New York World's Fair. The importance of modern high-speed grinding in the manufacture of precision-made instruments and machine parts is dramatized*



European

Getting Set—*England's armament industry is being taxed to its utmost trying to keep pace with ever accelerating production on the Continent. Here a 16-in. naval gun is being bored out after relining at the Woolwich Arsenal*

Exports of Machinery During February, 1939

	February 1939	January 1939	February 1938
Electrical machinery	$6,954,372	$6,719,583	$7,694,880
Power generating machinery except automotive and electric	876,963	746,076	1,459,301
Construction and conveying machinery	1,765,537	1,479,316	1,832,824
Mining, well and pumping machinery	4,985,230	4,439,621	4,674,442
Power driven metal-working machinery	7,832,893	6,340,620	9,459,830
Other metal-working machinery	307,018	332,635	353,865
Textile machinery	557,178	656,890	755,445

Exports of Metal-Working Machinery During February, 1939

Engine lathes	607,586	505,688	850,553
Turret lathes	552,591	384,257	690,923
Other lathes	122,856	145,049	287,521
Vertical boring mills and chucking machines	290,461	308,191	190,190
Thread cutting and automatic screw machines	337,331	225,119	513,032
Knee and column type milling machines	427,722	302,917	419,336
Other milling machines	1,168,583	548,960	775,607
Gear-cutting machines	283,964	238,616	309,043
Vertical drilling machines	95,259	60,503	193,960
Radial drilling machines	63,775	24,927	161,730
Other drilling machines	113,570	75,683	156,169
Planers and shapers	254,959	239,147	127,313
Surface grinding machines	218,805	106,407	199,631
External cylindrical grinding machines	304,243	216,848	605,488
Internal grinding machines	180,510	277,928	965,647
Tool grinding, cutter grinding, and universal grinding machines	145,435	205,972	340,035
Other metal-grinding machines and parts	576,646	452,439	240,510
Sheet and plate metal-working machines and parts	327,637	342,085	425,561
Forging machinery and parts	506,933	313,789	356,247
Rolling mill machinery and parts	675,551	603,402	788,020
Foundry and molding equipment and parts	47,820	74,698	104,472
Other power-driven metal-working machinery and parts	530,656	687,495	758,842

Other Metal-Working Machinery

Pneumatic portable tools	81,084	109,152	161,118
Portable and hand and foot operated metal-working machines and parts	86,817	121,395	91,448
Chucks for machine tools	17,548	13,953	16,249
Milling cutters, machinery operated thread dies and taps and similar machinery operated metal cutting tools	74,376	31,398	42,494
Other metal-working machine tools	47,193	56,737	42,556

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Molding departments are planned by two large auto manufacturers. Allison expansion waits for government contract.

DETROIT—Molded plastic parts are required in such volume that automobile manufacturers are thinking of savings to be effected by doing more of the work themselves, rather than letting it out to custom molding plants. Equipment needs are being discussed now by Chrysler and by the Ternstedt Division of Fisher Body.

Chrysler, it is understood, will spend between $300,000–$400,000 to set up a plant to make such molded parts as steering wheels, grilles, dash panels and rims for reflectors. Ternstedt is reported to be inquiring for approximately $200,000 worth of equipment for its new Trenton plant. From there it would supply General Motors' eastern assembly plants.

Both of these proposed ventures are likely to be the forerunners of larger developments along these lines. Opinion in trade circles is that several million dollars worth of equipment will be needed to make these two corporations independent of custom molders. It is problematical whether such a state of affairs is desired. More likely, the new plants will be used to check costs and to provide additional knowledge of the problems involved in making plastic parts.

Considerable progress has been made at Ford in development of large panels for external parts of the car. It is unlikely, however, that 1940 models will incorporate molded hoods and rear deck panels, but 1941 models will probably feature them. And "rubber" fenders are not a joke.

The purpose of such experiments is not to cheapen but to lighten the car. Even the lowest-priced jobs have grown in weight as well as power, wheelbase and over-all body length. The Ford, for example, is perhaps 300 lb. heavier than it was three or four years ago. Load-carrying components will not be sacrificed in the interest of lightness. Axles, steering knuckles, radius rods are always to be more than amply strong. But dash panels, hoods, rear deck panels, and even fenders, are not load-carrying components. They can well be made of a suitable plastic instead of steel, in order to reduce weight.

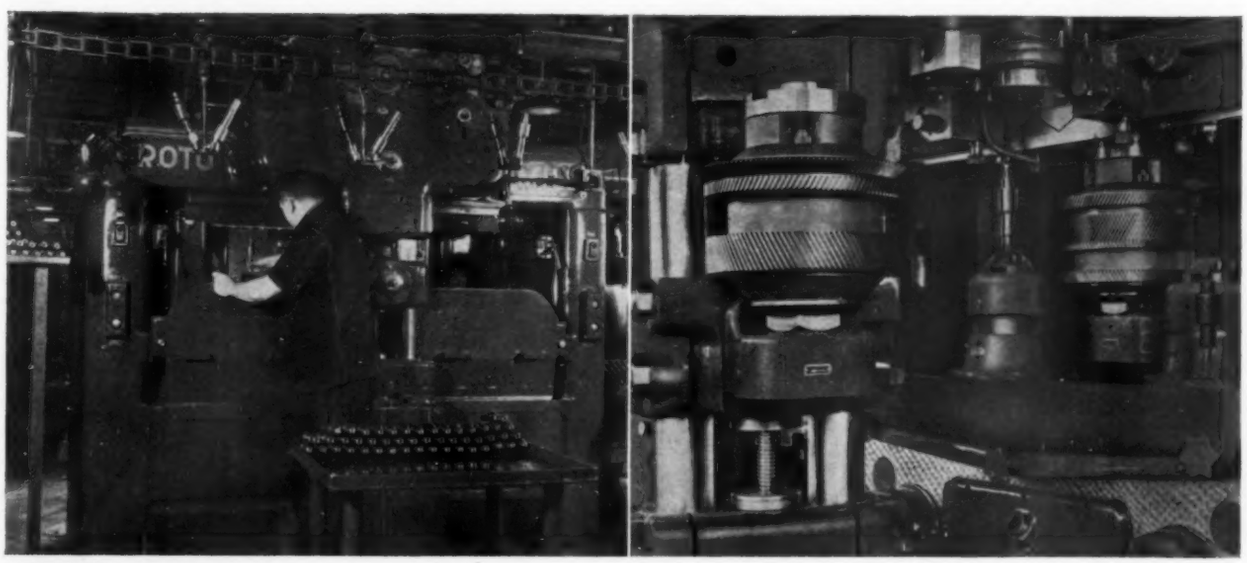
It is said that a glove-compartment door, for example, weighs 6 lb. in steel and only a few ounces in plastic. Similarly weight might be taken out of a hood. If it weighs 35 lb. as now made from steel, it might weigh only 5 lb. in plastic, and be suitable.

General Motors officials say that facilities will not be expanded for production of the Allison water-cooled engine at Indianapolis until a contract is received from the U.S. Government. Whether such a contract will be let in the next few weeks depends somewhat, it is believed, on the European situation. If matters cool down, the government might not go ahead with procurement of enough engines to warrant the expansion program. In that case, observers say, the corporation may decide to go ahead with some kind of expansion program for the British or French governments. Several equipment builders were asked to start machines through the works without an official order, with the suggestion that the machines would be needed in any case, and in a hurry when a decision had been reached on which government would get the engines.

MILLIONS FOR DIES

DETROIT—Extensive body changes will be made by all concerns that can afford them, in the opinion of the local die trade. Fisher Body has let contracts worth over $1,000,000 to several shops, mostly for Buick and some for Oldsmobile and Chevrolet.

All General Motors cars will be greatly changed. Chevrolet has an extensive program involving between $1,500,000–$2,000,000 for a considerably different front end. Various divisions of Chrysler Corp. are again expected to make extensive body changes totaling millions for new press tools, and to let contracts soon.



RotoMill—*A prominent manufacturer of low-priced automobiles has made the first installation of a RotoMill for machining transmission shafts on several surfaces at once. The shaft is an S.A.E. 5145 forging, and ½ lb. of metal is removed per shaft at the rate of 200 shafts per hour. Accuracy is 0.002 in. on the outside diameter, with a total indicator runout of 0.004 in. Right, a reciprocating table with a work spindle at each end carries a transmission shaft between the RotoMill cutters at each table reversal. The work revolves 370 deg. to insure a clean cut. On average jobs it is possible to get from 1,500–2,000 pieces per grind. National Broach and Machine Co. builds the RotoMill*

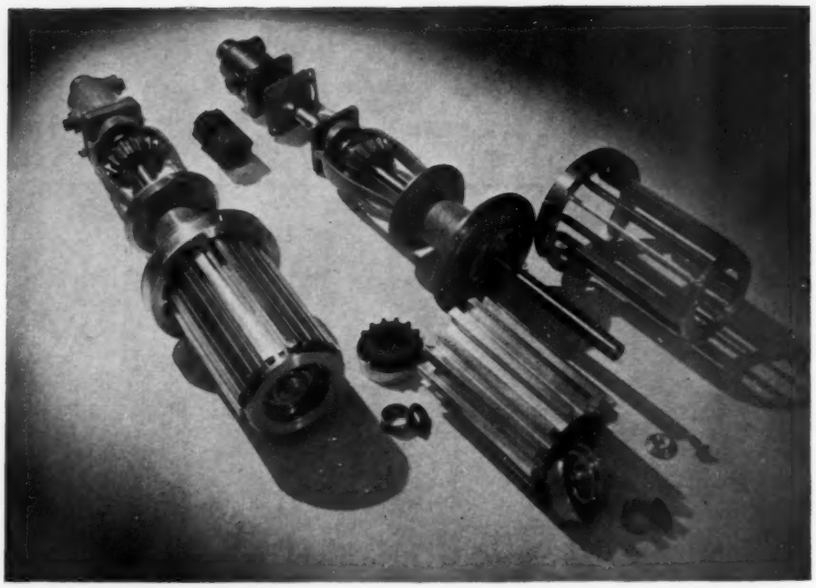
ADOPTION OF ENAMEL FINISHES WILL SPUR EQUIPMENT BUYING

DETROIT—A change from lacquer to synthetic enamel finishes evident in the automobile industry promises considerable work for equipment manufacturers. Large installations for baking synthetic enamels were made over a year ago, principally by the Chrysler divisions, and some good-size orders are again being negotiated by undisclosed sources. Equipment builders have been given to understand that the model changeover may come in June or early July and have been told to be ready for prompt action.

Reasons why industrial and automotive finishers are changing from lacquers to synthetic enamels are: (1) the latter are tougher and withstand more abuse, (2) they do not require so much rubbing, (3) they will stick on surfaces to which lacquer will not, (4) a thicker deposit is left per spraying because there is not as much solvent to be evaporated, and (5) their ability to hide surface defects in the steel is greater.

Considerable revamping of equipment is necessary when a changeover is made. Lacquer is "baked out" in 20 min. at 175 F. Enamels require from 250–375 F. for periods of 30 min. to one hour. Sealed, dustproof finishing rooms are required, and they must be supplied with filtered air which is often maintained at 35–40 per cent relative humidity. Spray booths must be of the water-wash type because synthetic enamel deposits are difficult to remove. Ovens must have a higher heat input. Water vapor in the oven atmosphere is a cut-and-try matter. Usually it is admitted from a steam jet.

Wall-Eyed—*Every square inch of the inside surface of oil well piping can be inspected with this "Tube-wall-scope" put into use by the Jones & Laughlin Steel Corp. With wells being driven to ever-increasing depths, such inspection is becoming more important in preventing fatigue breaks resulting from seams, cracks, slivers or pits in the steel*



Extruded, Cast, Forged—*Over 30 tons of aluminum went into the 9,600 drying reels of the Industrial Rayon Corporation's new continuous viscose spinning machines at Painesville, Ohio. Most important considerations were good heat conductivity and high surface polish. Spider at the extreme right, a permanent-mold casting, is assembled with an extruded reel sprocket, center, to form the complete reel and driving assembly at left. The aluminum forging leaning against the sprocket is expanded into it by the dry ice process, preventing the escape of the circulating hot water which provides the heat for drying the filaments*

U. S. Government Contracts Awarded to Metal-Working Firms

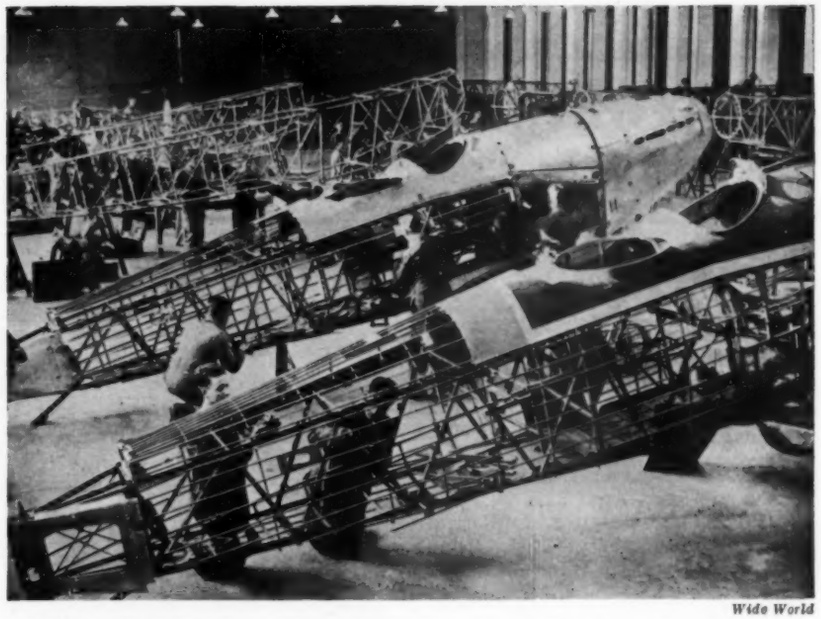
(Awarded from March 20–April 1)

Contractor	Gov't Agency	Commodity	Amount
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.	Navy, Panama Canal.	Steel	$107,790
Inland Steel Co., Indiana Harbor, Ind	War, Engineers	Steel sheet piling	83,782
National Malleable & Steel Castings Co., Sharon, Pa	Navy, S. & A.	Chain and fittings	61,072
American-LaFrance Foamite Co., Elmira, N. Y.	Navy, S & A.	Fire extinguishers	32,858
General Motors Corp., Cleveland Diesel Engine Div., Cleveland, Ohio	Navy, S. & A.	Diesel engine parts	25,488
Baldwin Southwark Corp., Eddystone, Pa.	Navy, S. & A.	Bending roll	74,825
National Automatic Tool Co., Richmond, Ind	Navy, S. & A.	Drill press	21,460
Jones & Lamson Machine Co., Springfield, Vt.	Navy, S. & A.	Turret lathes	18,691
Monarch Machine Tool Co., Sidney, Ohio	Navy, S. & A.	Lathes	66,291
DeLaval Separator Co., Poughkeepsie, N. Y.	Navy, S. & A.	Oil purifiers	22,299
Galion Iron Works & Mfg. Co., Galion, Ohio.	Farm Sec. Admn.	Road rollers	33,556
Vulcan Copper & Supply Co., Cincinnati, Ohio	War, Ordnance	Alcohol rectification equipment	31,740
Grumman Aircraft Eng. Corp., Bethpage, N. Y.	Treasury	Airplanes	204,000
Sperry Gyroscope Co., Brooklyn, N. Y.	Navy, S. & A.	Aircraft pilots	119,070
Air Cruisers, Inc., Clifton, N. J.	War, Air Corps	Oxygen cylinder assemblies	41,790
Crucible Steel Co. of America, New York, N. Y.	Navy, S. & A.	Alloy steel forgings	26,427
Mercer Tube & Mfg. Co., Sharon, Pa.	Navy, S. & A.	Steel pipe	54,496
International Nickel Co., New York, N. Y.	Navy, S. & A.	Nickel-copper forgings	397,556
Caterpillar Tractor Co., Peoria, Ill.	War, Engineers	Tractors, parts	49,000
Warner & Swasey Co., Cleveland, Ohio	War, Ordnance	Turret lathe	14,534
Sundstrand Machine Tool Co., Rockford, Ill.	War, Ordnance	Milling machines	60,086
American Tool Works Co., Cincinnati, Ohio.	Navy, S. & A.	Engine lathes	15,589
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio	Navy S. & A.	Engine lathes	34,755
Pratt & Whitney Div., Niles-Bement Pond Co., Hartford, Conn.	Navy, S. & A.	Vertical shapers	12,088
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy, S. & A.	Boring mill	152,800
W. E. Shipley Machinery Co., Philadelphia, Pa.	Navy, S. & A.	Grinding machine	34,795
Warren Steam Pump Co., Warren, Mass.	Navy, S. & A.	Pumps	40,369
Elliott Co., Ridgway, Pa.	Interior	Electric motors	104,280
General Electric Co., Schenectady, N. Y.	Interior	Power transformers	376,350
North American Aviation, Inc., Inglewood, Calif.	War, Air Corps	Airplanes	2,346,127
Grumman Aircraft Engineering Corp., Bethpage, N. Y.	Navy, S. & A.	Airplane parts	21,726
Sperry Gyroscope Co., Brooklyn, N. Y.	Navy, S. & A.	Automatic pilots	39,300

URGE BETTER UNDERSTANDING IN PUBLIC RELATIONS FORUM

CLEVELAND—"Whether it knows it or not, business is in politics. A politician only has to run for office at stated intervals, but American business must seek popular support every day indefinitely into the future," according to W. T. Holliday, president Standard Oil Co. of Ohio, at the McGraw-Hill Public Relations Forum held here April 6. Mr. Holliday and T. G. Graham, vice-president B. F. Goodrich Co., led the discussion of basic public relations problems in industry before a meeting of 100 leading business executives in the Pittsburgh and Cleveland areas.

J. H. McGraw, Jr., president of the McGraw-Hill Publishing Co., in opening the Forum, pointed to confusion in industrial thinking as being largely responsible for the bewildered attitude on the part of the public toward all public relations work. "We realize, of course, that the problem differs in detail with every situation", said Mr. McGraw, "but, we are convinced that a common understanding as to its fundamentals can be achieved. We feel very strongly the urgent need of a simpler definition of public relations and its objectives, and of a much wider exchange of ideas and methods. In the last analysis, however, the responsibility for solving the public relations problems of the day lies directly in the hands of such groups as these; and no solution is possible until each of you has established sound public relations with your own employees, your own customers and with the communities in which your plants operate."



Wide World

"Just In Case"—*In a desperate attempt to catch up to German aircraft production, English airplane factories are working wide out on a 24-hour day basis. Above, alignment of trainer fuselages is being checked in one of the famous British "shadow plants"*

PLAN USE OF POWDERED IRON

DETROIT—Powdered iron has been talked about considerably in automotive circles recently. Its chief appeal is that it can be made into car parts in much the same way as plastics, with little further processing necessary. Its high cost, however, makes it almost prohibitive at present.

MACHINERY EXPORTS TO JAPAN CONTINUE DESPITE OPPOSITION

WASHINGTON—Despite pressure to curb exports to Japan of products which might increase her military strength, total shipments for the six months ending January 31, 1939 increased more than $17,000,000 over the corresponding period of the previous year. Sharing prominently in this advance were exports of machine tools, which increased from $9,199,642 to $12,103,373 in that time.

Aircraft sales for the same period rose from $1,722,631 to $4,696,920, while scrap iron and steel shipments rose from $8,406,969 to $10,521,873.

Seeing is Believing—*Before teeth are cut in Pontiac rear axle ring gear blanks, each unit is inspected for correct inside diameter, outside diameter and concentricity. Inspection department is operated as a separate organization*

REVEAL EMPLOYMENT ECONOMICS

CHICAGO—Economic principles essential to employment expansion in the United States and basic conflicts between a spending policy and a program of saving and investment in productive enterprise are discussed in a book published by the Machinery & Allied Products Institute under the title "Capital Goods and the American Enterprise System."

According to William J. Kelly, president of the Institute and president of Arthur J. O'Leary & Son Co. of Chicago, the volume is "a studied statement of economic and social principles, issued in response to the desires for such views expressed by representatives of the national government, notably Secretary of Commerce Hopkins and Senator O'Mahoney, chairman of the Temporary National Economic Committee."

WATCHING WASHINGTON

McGraw-Hill Washington Bureau
PAUL WOOTON, CHIEF

Progress on National Defense program speeded by prompt legislative action. "Emergency" rulings avoid delays caused by unforeseen technicalities.

WASHINGTON—A quick look at the National Defense program:

War Department Expansion: Signed by the President April 3, it is public law No. 18, 76th Congress. Authorizes appropriation of $300,000,000 to bring air force to 6,000 planes, $27,750,000 for construction at Panama, and $34,500,000 for educational orders.

Regular Military Establishment, 1940: Provides about $170,000,000 for airplanes, including $50,000,000 to be available immediately for order of about 565 combat planes. Passed by House and Senate and on way to conference as this is written.

Second Deficiency. Contains $55,000,000 for ordnance and supplies plus $44,000,000 contract authority; $5,478,287 for seacoast defense; $1,086,195 for Civil Aeronautics Authority buildings and research at Langley Field; $2,378,000 for buildings and research for National Advisory Committee for Aeronautics; $36,000,000 for replacement of Naval vessels.

Critical Raw Materials: The Senate cut its Military Affairs Committee's recommendation from $25,000,000 per year to $10,000,000 per year for four years for purchase of critical metals, passed the bill, and sent it to the House Military Affairs Committee.

Regular Navy Establishment, 1940: Not yet introduced; hearings are being held by House Appropriations. President Roosevelt has sent in a supplemental estimate of $19,574,500, which covers increase of budget estimate for the Bureau of Aeronautics from $24,000,000 to $88,298,000, and for new aircraft from $37,600,000 to $51,989,000.

Navy Expansion: Authorizing appropriation of $65,000,000 for fifteen air bases in the two oceans. Passed by the House and approved by Senate Naval Affairs, which delayed it awaiting further reports which resulted in addition of the $17,000,000 Jacksonville base. Also added was authorization of $1,000,000 for a base site in Rhode Island.

Neutrality: Present law empowers the President to embargo munitions to belligerents and to permit export of other supplies on cash-and-carry basis. Seven proposed measures are in hearings before the Senate Foreign Relations Committee. The Administration wants to modify restrictions against sale of "implements of war."

Educational Orders: $2,000,000 is appropriated for this year in the regular Army supply for 1940. The President this week sent a request to Congress for the balance ($32,500,000) of the $34,500,000 authorized in the Army expansion law.

Navy Public Works, 1940: The bill for $37,000,000 for Naval shore stations was reported by House Naval Affairs, and cleared by House Rules Committee.

Confer on Wage-Hour Amendments

Executive meetings on the wage-hour amendments proposed jointly by Administrator Andrews and Representative Mary Norton are still in progress in the House Labor Committee. The Committee has not voted whether to hold hearings, and it is assumed there will be none. Proponents of the law hesitate to give enemies a chance to snipe at it. Only opposition to the amendments so far is by farm associations, who object to inclusion of more rural workers. Of main interest to metal-working employers is exemption of salaried employees getting $200 or more per month. It probably will be included with other changes expected this session.

AID "LITTLE BUSINESS"

"Small business" men, so numerous in metal-working, may expect more substantial financial aid as a result of the anti-monopoly committee's work than that which resulted from last year's "little business" comedy in Washington. The O'Mahoney anti-monopolists feel that one effective safeguard against monopoly is the prosperity of small business and its employees. It looks now as if the Committee may be able to whisper something nice about the little men in the ear of Congress and the S.E.C. and that favorable legislation may be enacted this year.

Secretary of Commerce Harry Hopkins last fortnight added his own move to that of T.N.E.C.-S.E.C. for the benefit of small businesses. He estimates there are 4,000,000 in that class, employing 15,000,000 workers. His idea is to establish research stations throughout the country to do for small business what only the big companies can do for themselves. He proposes that Congress amend a pending economic research bill specially to emphasize service to small concerns. The next Congress will get an extensive report on the relation between big and little business, and broader legislation may be looked for in 1940.

Navy Jumps the Gun

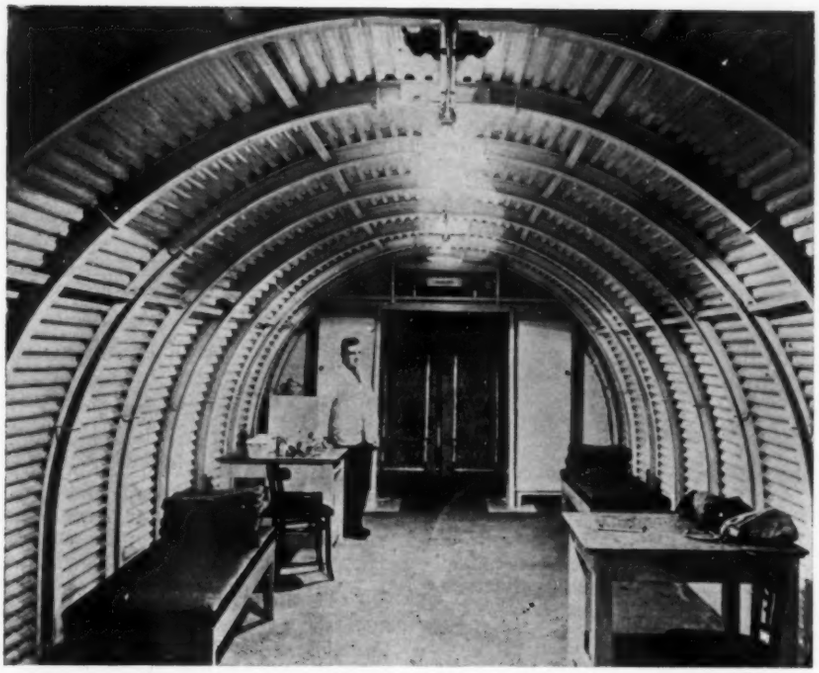
For the first time in history the Navy jumped the appropriations gun and called for bids on construction before the money was made available. While Army took the trouble to get legal approval for a similar trick on airplane bids, Navy apparently skipped the formalities. Bids were asked on four destroyers and four submarines, half of the total of such ships Congress is expected to appropriate for. One of the subs is a new type of about 800 tons as compared with the usual 1,500 tons, which will take about half the usual 30 months to build. Bids are to be opened at noon May 24, by which time it is anticipated the regular 1940 supply bill will have been signed.

Fight Fire with Fire

Senator James F. Byrnes' proposal to swap American cotton and wheat for foreign tin and rubber war reserves lines up with two other federal policies: (1) to find a means of reducing crop surpluses; (2) to build reserve piles of critical and strategic raw materials for emergency. Congress is already considering a bill to authorize spending $10,000,000 a year for scarce metals. This bill, however, has no direct connection with Byrnes' proposal. This is the kind of thing that might go over now. If it does it may be expanded to cover a number of crops, a number of needed imports. It's just plain barter, for which practice we have denounced other countries. But Secretary Hull, and the President, are strong for it.

Machinery for Relief, and Vice-Versa

P.W.A. spent $351,272,270 for machinery between June 1933 and January 1939, according to a study by the Bureau of Labor Statistics. The purchases were to equip various projects. Elevators and equipment $11,142,675; engines, turbines, tractors, water wheels, $3,716,551; foundry and machine shop products, $174,285,301; machine tools, $8,799,919; gas generators and meters, $2,008,206; pumps and pumping equipment, $24,189,450; refrigerators and ice-making apparatus, $4,028,527. The Bureau estimated that 1,675,739,000 man-hours of work had been created.



European

The British Dig In—*Steel-lined bomb-proof shelters such as this have been constructed in England for use when "the next war" breaks out. Intended solely for use as underground first aid stations, these shelters cannot be bought by individuals or communities*

TOTAL WALSH-HEALEY AWARDS NEAR BILLION-DOLLAR FIGURE

WASHINGTON—At the conclusion of the first quarter of 1939, 13,125 contracts valued at $907,379,687 had been awarded to contractors throughout the United States and its territories under provisions of the Walsh-Healey Public Contracts Act.

Awards for transportation equipment were greatest in dollar volume of the industrial classifications, accounting for over $297,000,000 worth of orders, or about 33 per cent of the total. Iron, steel and their products ranked fourth with almost $70,000,000 in contracts, representing over 7 per cent of the total.

"Other machinery", accounted for almost as much, with $54,000,000, with electrical apparatus next in line, with well over $51,000,000 in contracts. Products included under the non-ferrous metals and alloys classifications ranked eleventh, with a $16,800,000 value, or slightly less than 2 per cent of the total.

PLANE EXPORTS INCREASE

WASHINGTON — Nearly $7,000,000 worth of planes and parts were exported during February, according to figures released by the Bureau of Foreign and Domestic Commerce, Department of Commerce. This represented a 38 per cent increase over those of January and a 31 per cent rise over February, 1938.

PREDICT USE OF LEADED STEELS

DETROIT—Automotive production men are much interested in the new lead-bearing steel. They say it is too new to be used extensively in 1940 models, but they look for it to be specified for a considerable number of parts in 1941 cars. The free machining quality of this new steel will help reduce machining costs.

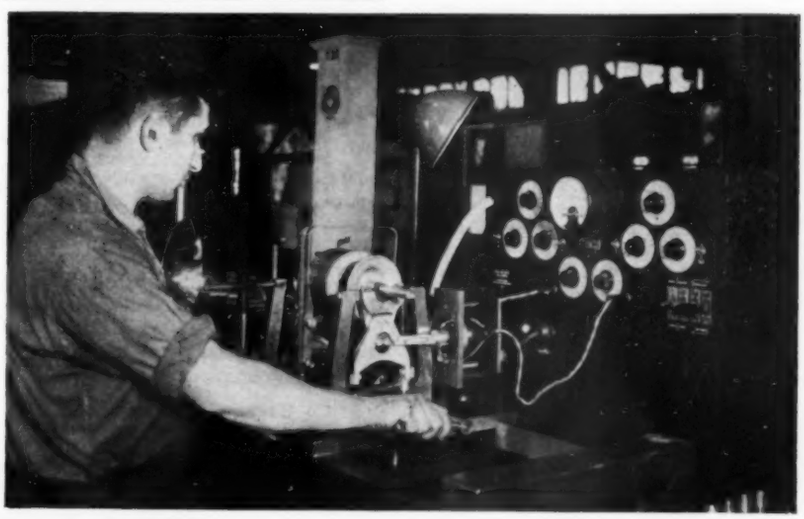
ATTRIBUTES OF MACHINE TOOL STRESSED BY A. H. TUECHTER

CINCINNATI—"The outstanding contribution of the machine tool is the fact that it makes mass production possible through the principle of interchangeability of parts," asserted August H. Tuechter, president Cincinnati-Bickford Tool Co., in an address for the Cincinnati Credit Association Luncheon Group. "It is impossible to exaggerate the importance of the machine tool in shaping our modern pattern of living. Almost everything we use or consume today is produced, at least in some vital part, by the machine.

"Aside from the fact that it has made innumerable products of high quality available, the machine tool has rendered many other services to the world," Mr. Tuechter continued. "Because of it, working hours have been shortened from the 1850 average, which was well above 60 hours per week, to the 40-hour average week of today. At the same time, thanks largely to machine tools, wages have increased until they are now four times what they were before the Civil War (when the industry was just getting into commercial production); three times what they were before the Spanish-American war, and double those prevailing before the World War."

Mr. Tuechter hastened to point out some facts peculiar to the industry. "While we manage to make a decent living, no one has ever gotten rich from the industry itself. . . .

"Again, we can never benefit from the profits of mass production, for ours is a special order business and our machine tools must be built a few at a time, as demand warrants."



No More Wobble—*This machine devised by Westinghouse Engineers to measure rotor unbalance reduces the once complicated problem of balancing, fraught with calculations, to a simple reading of meters. Accurate far beyond commercial requirements, the machine will indicate an unbalance of 0.001 oz.-in. It will be exhibited at the New York World's Fair.*

ALVAN MACAULEY

M. M. GILMAN

PERSONALS

ALVAN MACAULEY, president Packard Motor Co. and for the past eleven years president of the Automobile Manufacturers Association, has been elected a director. He is succeeded by M. M. GILMAN, vice-president and general manager.

Mr. Macauley first became associated with Packard in 1910, when he joined the organization as general manager. He enjoys the distinction of having been president longer than any other automobile company president.

Mr. Gilman entered the company's employ in 1919 in the capacity of a salesman. He subsequently managed various departments, and was later appointed vice-president in charge of sales. In 1932 he was named vice-president in charge of distribution, and two years later was appointed vice-president and general manager.

JOHN M. WILSON, president National Supply Co., Pittsburgh, Pa., has been elected chairman.

CHARLES L. RICE, vice-president Western Electric Co. and manager of its Hawthorne works in Chicago, has been elected a director.

THOMAS E. MILLSOP, president Weirton Steel Co., Weirton, W. Va., has been elected a vice-president of National Steel Corp., Pittsburgh, Pa.

G. S. ALCORN, formerly assistant to the manager, has been appointed sales manager of the wiring device section of the General Electric appliance and merchandise department, Bridgeport, Conn.

K. M. CHASE, for the past five years regional manager on the Pacific Coast, has been appointed Atlantic Coast regional manager, Chevrolet Div., General Motors Corp. He succeeds HARRY L. HORTON, who has been appointed to the staff of W. E. HOLLER, general sales manager.

LESLIE C. ALLMAN has been named vice-president and public relations director, Fruehauf Trailer Co., Detroit, Mich.

A. J. AULERICH, Progressive Welder Co., Detroit, has been placed in charge of the company's sales office in Dayton, Ohio.

C. I. AUTEN, former vice-president Truscon Steel Co., Youngstown, Ohio, has been appointed sales manager of the cold formed steel division, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

JOHN C. CHAFFE, formerly of the Philadelphia district sales office, Republic Steel Corp., has been appointed assistant district sales manager of the Philadelphia territory.

L. H. CHAMBERLAIN, since 1926 district manager of the Water Works Supply Co. and the U. S. Pipe & Foundry Co., Los Angeles, Calif., has been appointed manager of the water works sales section of the Crane Co., Chicago, Ill.

A. T. COLWELL, engineering vice-president, Thompson Products Inc., Cleveland, Ohio, has been elected a director.

DAVID DASSO, vice-president of the diesel engine division, American Locomotive Co., has resigned.

L. M. DETURK, mechanical engineer associated with the J. G. Brill Co., New York, N. Y., has been named manager of the parts and service department. He succeeds C. S. DAHLQUIST, resigned.

A. C. HANSON has been appointed district representative and sales engineer for the Detroit territory of the Foote Bros. Gear & Machine Corp., replacing EVERETT G. AKRIDGE.

WILLIAM G. HUME has been named general sales manager, Pittsburgh Steel Co., Pittsburgh, Pa.

WILLIAM A. IRVIN, vice-chairman of the board, U. S. Steel Corp., has retired. He will continue to serve as a director and as a member of the finance committee.

C. D. JAHNKE, general manager Cooper-Bessemer Corp., Mount Vernon, Ohio, and W. C. HEATH, president A. O. Smith Corp., Milwaukee, Wis., have been elected directors of Cooper-Bessemer.

RALPH B. KRAFT has been appointed manager of the roll sales department, Lewis Foundry & Machine Div., Blaw-Knox Co., Pittsburgh, Pa.

F. R. MAYS has been appointed general manager of the Illinois Central Railroad. His promotion restores the position of general manager, which was combined with that of operating vice-president when WILLIAM ATWILL was named vice-president and general manager in 1934. Mr. Atwill will continue as vice-president in charge of operations.

T. H. MCSHEEHY, Chicago district manager Wickwire Spencer Steel Co., New York, N. Y., has been appointed head of the hardware products department, which has been moved from the company's New York offices to Chicago.

WALTER P. MURPHY, president Standard Railway Equipment Co., last week gave Northwestern University a gift of $6,735,000 to found an Institute of Technology. The Institute is to operate on a cooperative plan with industries of the Middle West on an alternate twelve-week period basis. Mr. Murphy with HERMAN SCHNEIDER, dean of engineering University of Cincinnati, as adviser has worked out the cooperative plan which is to be undertaken experimentally for a five-year period. O. W. ESHBACH, personnel director American Telephone & Telegraph Co., has been offered the deanship.

Most of the donation will go for building and equipment while $50,000 will be used for scholarships and fellowships. Construction of the new institute will double present engineering school space and will provide for 800 students. Building is expected to be ready by September, 1940.

GEORGE C. PRATT, vice president Electrical Research Products, Inc., New York, N. Y., in charge of West Coast operations in Hollywood, Calif., retired April 1 following thirty-three years of continuous service with the Bell System. He will be succeeded by CLIFFORD W. SMITH, former general manager.

P. D. RESENHOUSE and ALEXANDER H. RUTHERFORD have been elected directors of Revere Copper & Brass Corp.

ERVIN J. SANNE has been appointed assistant sales manager, sheet and strip steel division, Inland Steel Co., Chicago, Ill. FREDERICK A. ERNST has been named district sales manager in St. Paul.

JOHN H. COLLIER, vice-president in charge of manufacturing, Crane Co., Chicago, has been elected a director. Other new directors include: SIDNEY C. MCALLISTER, president International Harvester Co.; W. R. ODELL, trustee of the estate of R. T. Crane, Jr.; and T. R. MORK, Crane's vice-president in charge of sales. P. T. KELLY, vice-president, has retired after 48 years of service.

H. N. OTT, since 1919 president Spencer Lens Co., Buffalo, N. Y., the scientific instrument division of the American Optical Co., has been elected chairman of the board. Mr. Ott is succeeded by B. H. WITHERSPOON, who will also serve in the capacity of general manager.

FRANK F. RUSSELL has been elected president, National Aviation Corp., Chicago. He succeeds EDWARD O. MCDONNELL, who has been named chairman of the board.

D. V. SAWHILL, former general manager Mercer Tube & Mfg. Co., Chicago, has been elected president, succeeding HENRY GREENBERGER.

JOHN R. SHEA, assistant engineer of manufacture, Kearny, N. J., works of the Western Electric Co., has been appointed works manager of the company's Point Breeze works at Baltimore, Md. He succeeds W. H. MEESE, deceased.

H. B. SPACKMAN, vice-president in charge of sales, Lyon Metal Products, Inc., Chicago, has been elected a director.

ROBERT C. STANLEY, president International Nickel Co., has been elected a member of the finance committee of the U. S. Steel Corp., succeeding WALTER S. GIFFORD, president American Telephone & Telegraph Co.

Glassy—*R. B. Mildon, Westinghouse vice-president, and Harold Boeschenstein, president Owens-Corning Fiberglas Corp., inspect the glass tape insulation on the stator coils of a giant water wheel generator being built by Westinghouse. Generator is the largest electrical machine to use this new insulating material*

J. H. COLLIER

H. N. OTT

JOHN H. SULLIVAN has been named vice-president in charge of manufacturing, Electric Household Utilities Corp., Chicago.

W. P. WOODSIDE, vice-president in charge of research, Climax Molybdenum Co., Detroit, Mich., has been elected a director, Reynolds Spring Co., Jackson, Mich.

BUSINESS ITEMS

Austin-Western Road Machinery Co. will spend $500,000 on new buildings and remodeling old ones in its 40-acre plant at Aurora to accommodate its recently announced transfer of all activities from Harvey. The largest of three units will be an assembly building, 521x120 ft., which will also contain offices and a cafeteria. A raw material building, 251x150 ft., will cost $100,000. The third will be a painting plant and loading platform, 75x180 ft., to cost $45,000.

Berger Mfg. Div., Republic Steel Corp., Canton, Ohio, is installing new presses, conveyor oven equipment, and conveyor lines in its No. 2 plant. The move is a continuation of an expansion program begun two years ago when the plant was acquired.

The Chicago, Burlington & Quincy Railroad has placed an order with General Motors for 25 air-conditioned diesel buses to be used on the Chicago-San Francisco run.

Construction of a new three-story addition (48x400 ft.) to the Chicago Flexible Shaft Company plant at a cost of $166,000 is to begin immediately. One floor will be for the installation of machinery already purchased and the other two floors for warehouse purposes.

The Delaware Electric Power Co., Wilmington, Del., has ordered a fleet of 55 trolley buses from the J. G. Brill Co. and the Mack Mfg. Corp. Majority of the electrical equipment for the order, which involves approximately $750,000, will be furnished by the General Electric Co.

Electric Motive Mfg. Co., New York, N. Y., manufacturer of small hardware and appliances, is transferring machinery to Willimantic, Conn., where operations will be carried on.

Hall Planetary Co., Philadelphia, Pa., thread-milling machine manufacturer, has appointed VICTOR BROOK, Rochester, N. Y. as representative.

Laminated Shim Co., Long Island City, N. Y., has appointed the M. E. Canfield Co., Los Angeles, Calif., as its California representative.

The McKay Co., Pittsburgh, Pa., chain and welding electrode manufacturer, has transferred its general sales, order, invoicing and purchasing departments to its factory in York, Pa. The executive department and a district sales office will remain in Pittsburgh.

Meehanite Metal Corp., Pittsburgh, Pa., has licensed the Lowes Foundry Co., Lower Hutt, New Zealand, and Booth-MacDonald & Co., Ltd., Christ-Church, Australia, to manufacture "Meehanite" metal.

Missouri Valley Electric Co., Kansas City, Mo., has been appointed wholesale distributor of the Allen-Bradley line of motor control equipment.

Montreal Locomotive Works, Ltd., Montreal, Que., has acquired the Canadian Steel Car & Wheel Co., Ltd., of Montreal. W. E. CORRIGAN, vice-president of the latter company, has been named vice-president of Montreal Locomotive.

Noble Machine Co., Fort Wayne, Ind., has sold its metal-working department to its former vice-president in charge of metal-working machinery, WATER H. MEYER. Offices will be maintained in the Noble Bldg., at 901-924 Hayden St., under the name of the Walter H. Meyer Machinery Co. Henceforth, the Noble Machine Co. will confine its efforts solely to wood-working machinery.

OBITUARIES

PHILIP E. BLISS, 53, HEAD OF WARNER & SWASEY CO., DIES

CLEVELAND—Philip E. Bliss, president of the Warner & Swasey Co., died on April 11 of a heart ailment in St. Lukes Hospital. Mr. Bliss was born in Cleveland in 1885, received his earlier education in the public school of North Fairfield and later attended Ohio Wesleyan University.

After serving as junior secretary of the Y.M.C.A. in Cleveland and New York City for several years, he became associated with the Warner & Swasey Co. in 1910. As the company's activities expanded, Mr. Bliss rose rapidly from the position of junior clerk in the accounting department until in 1928 he became president, an office which he held until the time of his death. His activities were to a great measure responsible for the company's successful history in recent years.

He served as president of the National Machine Tool Builders Association in 1927–28. He was a member of the executive committee of the National Industrial Conference Board, Army Ordnance Association, Cleveland Engineering Society, Union Club of Cleveland, Union League Club of New York and the Phi Delta Pheta fraternity.

Mr. Bliss was widely known in the machine tool industry and in other branches of the metal-working field. A few days ago he witnessed the completion by his company of the 82-in. reflecting telescope which is to be dedicated at the University of Texas Observatory early next month. He took a keen interest in the welfare of his company's employees and encouraged them at all times to come to him with their problems.

JOHN E. KENDALL, 69, former sales manager and direcor, J. D. Adams Co., Indianapolis, Ind., died recently.

HUGH M. RICHARDS, strip and sheet sales manager American Rolling Mill Co., Middletown, Ohio, died April 6 in that city at the age of 51.

WALTER H. NEUBERT, chief tool supervisor A. O. Smith Corp., Milwaukee, Wis., died recently in that city. He was 62 years of age.

THOMAS S. GRUBBS, vice-president Union Switch & Signal Co., Swissvale, Pa., died in that city April 2. He was 66 years old.

JOSEPH FARRELL, for the past 16 years a mechanical engineer associated with the Seth Thomas Clock Co., Thomaston, Conn., died March 24 following a brief illness.

Blank & Stoller

PHILIP E. BLISS

COL. S. M. NICHOLSON

COL. SAMUEL MOWRY NICHOLSON, president of the Nicholson File Co. and of the American Screw Co., Providence, R. I., died April 7 at his home in that city after an illness of several months. He was 78 years of age.

Col. Nicholson was born in Providence in 1861, and in 1879 entered the employ of the file company of which his father, the late WILLIAM T. NICHOLSON was founder and president. He progressed in both shop and accounting phases of the business and in 1881 was made secretary, in 1890 a director, in 1891 vice-president, and on the death of his father in 1893, succeeded him as president and general manager.

J. R. FORRER, for the past 40 years prominent in the activities of the machine tool industry, died March 12 in Zurich, Switzerland, following a sudden illness.

EDWARD GRAY, former chief engineer for the Ford Motor Co., died in Detroit April 3 following a short illness. He was 66 years of age.

DR. HERMAN SCHNEIDER, 67, founder of the co-operative system of education in this country and formerly president of the University of Cincinnati, died March 28.

Dr. Schneider was president of the University from 1929 to 1932 when he was succeeded by Dr. Raymond Walters. Since then he has been Dean of the College of Engineering. He has also been acting as adviser to Walter P. Murphy who recently gave $6,750,000 to Northwestern University for a co-operative engineering school.

HENRY A. WISE WOOD, inventor of high-speed newspaper presses and chairman of the Wood Newspaper Machinery Corp., died of pneumonia at his New York City home following a brief illness. He was 73 years of age.

MEETINGS

AMERICAN ELECTRO-PLATERS' SOCIETY. International convention, Asbury Park, N. J., June 19–22. W. J. R. KENNEDY, executive secretary, 90 Maynard St., Springfield, Mass.

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual meeting, Hotel Cavalier, Virginia Beach, Va., May 15-17. J. C. MCQUISTON, secretary, 602 Shields Bldg., Wilkinsburg, Pa.

AMERICAN IRON AND STEEL INSTITUTE. General meeting, Hotel Waldorf-Astoria, New York, N. Y., May 25. Executive secretary, WALTER S. TOWER, 350 Fifth Ave., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting and exhibit of apparatus and instruments, Chalfonte-Haddon Hall, Atlantic City, N. J., June 26-30. R. E. HESS, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

ASSOCIATED MACHINE TOOL DEALERS OF AMERICA. Spring convention, Van Curler Hotel, Schenectady, N. Y., June 5 and 6. THOMAS A. FERNLEY, JR., executive secretary, 505 Arch St., Philadelphia, Pa.

NATIONAL METAL TRADES ASSOCIATION. Annual convention, Palmer House, Chicago, Ill., May 24-25. O. R. ABBOTT, office manager, 122 S. Michigan Ave., Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. World automotive engineering congress, Hotel Pennsylvania, New York, N. Y., May 22-28; Hotel Statler, Detroit, Mich., May 31-June 8; Hotel Fairmont, San Francisco, Calif., June 6-8.

STEVENS ENGINEERING CAMP. Ninth annual economics conference of engineers, Johnsonburg, N. J., June 24-July 3. James Creese, vice-president, Stevens Institute of Technology, Hoboken, N. J.

SHOP EQUIPMENT NEWS

Model 2AA Automatic Screw Machine Can Be Operated at High Speeds

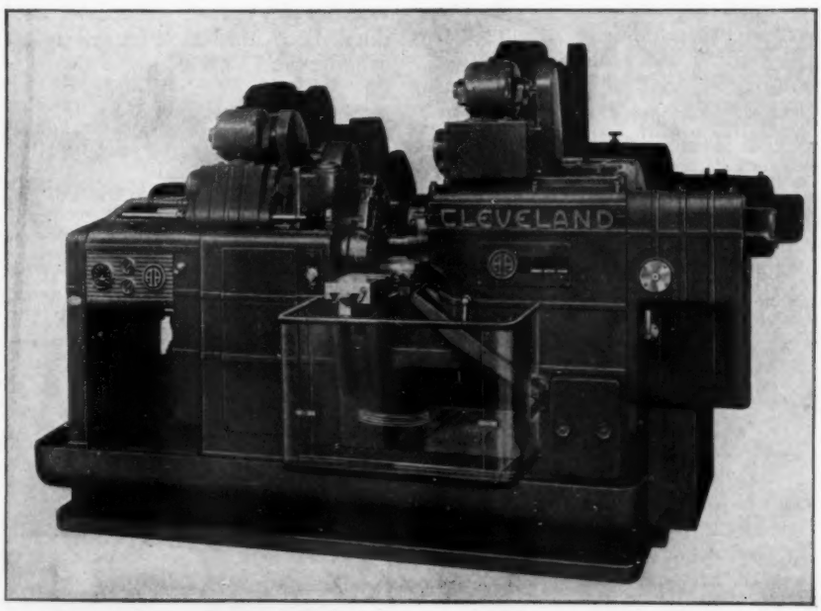
Maximum flexibility for first- and second-operation work on brass and steel bar up to $1\frac{1}{16}$ in. in diameter is incorporated in the completely redesigned Model 2 AA single-spindle automatic screw machine offered by the Cleveland Automatic Machine Co., Ashland Ave., Cleveland, Ohio. Design of this machine permits operation at up to 3,275 r.p.m., making the unit adequate for brass bar work in its field of work size.

While the machine will perform a number of operations by means of the usual six-tool turret, front and rear cross slides and cut-off slide, a number of quickly changed attachments are provided for second-operations on work chucked in a second spindle. Other attachments are provided for the first-operation turret and for rechucking in the first operation spindle, so as to perform operations on the cut-off end of the piece. This machine retains the principles of universal camming, so that set-up men and operators are not forced to learn a new technique because of the change in design.

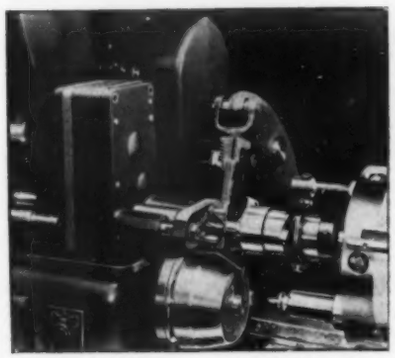
The spindle head is an all-geared unit having shaved gears for operation at high speed and is provided with pre-loaded anti-friction bearings. Quick acting shifters control the metallic friction clutches. Spindle speeds, which incorporate 36 fast and 36 slow forward speeds, as well as 36 reverse speeds, are secured through change gears. At any setting a high-forward speed, a low-forward speed and a low reverse speed are obtained automatically.

The basic machine is designed to receive any standard attachment without change. In the group of attachments operating on the cut-off end of the work there are: (1) a slotting, facing, and slabbing attachment, (2) a burring, chamfering, counterboring, high-speed drilling, centering and spot facing attachment, and (3) a tapping and threading attachment. These are readily interchanged on the standard plate of a motorized unit mounted above the spindle head. Another motorized drive unit can be mounted above the tool turret to drive a high-speed drilling spindle, which can be inserted in any turret tool hole. This drilling attachment can be used before the piece is cut off, or in the case of magazine-fed work, before the work is unchucked. Other attachments include a cross-slide turning attachment, air chucking, and an independent cut-off unit.

Specifications: Chuck capacity, $1\frac{1}{16}$-in. diameter round stock; length of stock feed $6\frac{1}{2}$ in.; distance of turret face to face of chuck, 6-10 in.; number of turret holes, 6; number of independent cross slides, 2; ranges of spindle speeds, 203-812, 408-1,632 and 818-3,275; indexing time for six holes, $2\frac{1}{4}$-$3\frac{1}{2}$ sec.; size of drive motor, $7\frac{1}{2}$-10 hp.; floor space required, 44x99 in.



The Cleveland Model 2 AA spindle-spindle automatic screw machine is shown with several individually motor-driven attachments in position. An instrument panel at the left has a spindle speed tachometer and two pressure gages



This high-speed drilling attachment, shown mounted for second operation work, also can be used for reaming, burring, chamfering or counterboring

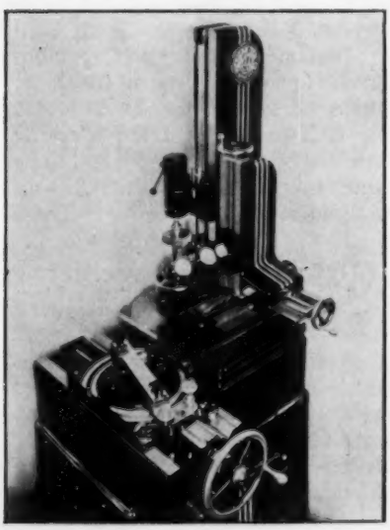
100-Amp. Arc Welder Joints Light Sheets

A transformer-type a.c. arc welder of 100 amp. rating at 30 volts is offered by Wilson Welder and Metals Co., Inc., 60 E. 42nd St., New York, N. Y., for light sheet metal welding and other work requiring low current and fine control. It is designed espe-

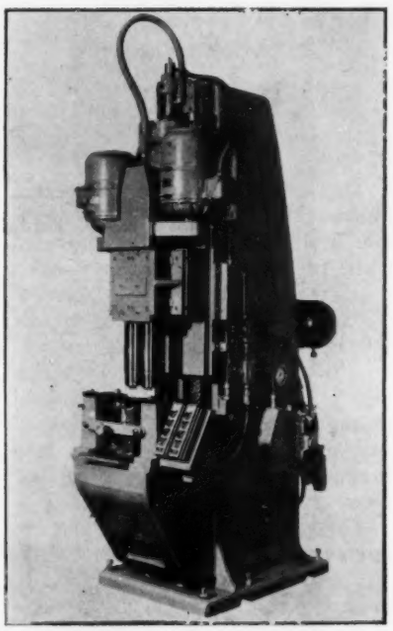
cially for use with heavily coated electrodes. Standard wiring is for single phase, 220 volts, 60 cycle power supply, but it can be furnished for 440 volt supply if desired. Open circuit voltage is 65 volts. A calibrated scale on the front of this welder indicates the adjustment throughout the range of the machine, which is from 25 to 150 amp.

Involute Checker Uses Master Tooth

The indicating head of an improved involute checker announced by Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., checks gears from a pitch diameter, using a master rack tooth which contacts the gear tooth. This machine is claimed to be easy to set up. The method of checking used is based on the fact that since involute forms are generated from a base diameter, the tangential movement of the rack tooth with relation to the gear is directly proportional to the angular rotation of the gear, regardless of the pressure angle and diameter. The actual amount of movement depends upon the base diameter of the gear and the pressure angle of the rack. The setting of the sine bar on the machine to provide this correct amount of movement is determined by a simple calculation.



Moline No. 113 Fine Boring Machine Uses Retracting Boring Heads



Arranged especially for finish boring the cylinders of a small two-cylinder engine block with single-point cemented carbide tools, this No. 113 vertical two-spindle fine boring machine made by Moline Tool Co., Moline, Ill., is equipped with complete electrical pushbutton control of motors, and feed cycles. The boring spindles are of the extended sleeve type, and each is driven through V-belts by a separate motor. A special application of Moline automatic retracting boring heads is used on these spindles to permit the boring of cylinders in which an interrupted cut occurs.

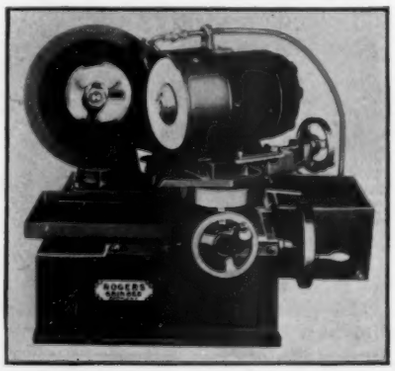
By using extended spindle type heads on this machine, cylinders having bores as small as 2½ in. diameter can be finished. From this as a low limit, the machine can handle diameters up to 5 in. The feed can be varied from 22 to 0.063 in. per min. On the machine shown, the center distance between the spindles can be set between 4½ to 12 in. by the manufacturer. The maximum stroke or travel of the boring spindle is 15 in., and the maximum distance from the bottom of the spindle, not including the tool or retracting boring head, above the plane on which the work rests is 16½ in. for the machine shown.

One group of four buttons serves to stop and start the spindle motors, and the hydraulic feed unit driving motor. The other group of four buttons is used to control the feed cycles. For the normal course of production work, the operator has only to press one of these buttons to initiate an automatic cycle, consisting of rapid advance of the tools to be worked, proper feed while boring, and rapid return of the tools to the starting position.

The retraction of the boring tools automatically by electrical means is interlocked with the control circuit and this action takes place whenever and for as long a time as rapid reverse travel occurs. The holding fixture shown is of the front-loading type, and machined surfaces on the work are used for locating without the use of dowels. Clamping pressure is applied from the front and top of the fixture. Estimated production of this machine is 17-20 cylinder blocks per hour.

Type C1 Grinder Used For Circular Knives

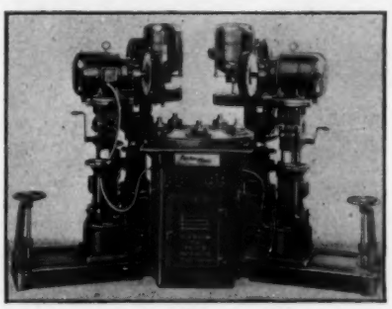
Having capacity for grinding all types of single or double circular knives from 1 to 8 in. in diameter, inclusive,



the Type C1 grinder developed by Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y., uses a 6x½x½ in. grinding wheel mounted on the spindle of a ¼ hp. totally enclosed motor. This motor is mounted for swiveling horizontally to permit grinding at any desired angle. The knife is rotated by a separate motor through a V-belt drive. Adjustments are provided by three slides with handwheel screw controls.

Automatic Polisher Has Five Stations

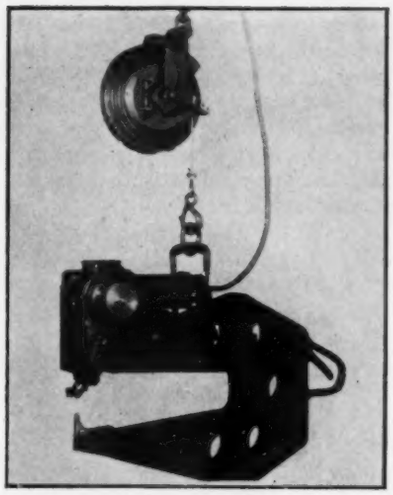
The "Packer-Matic" No. 4 rotary-type automatic polishing and buffing machine has five work stations and four individually motor driven wheel stands. The wheel heads can be arranged for mounting the wheels di-



rectly on the motor spindle, or with multiple V-belt drive so that wheel speed can be changed by changing the sheaves. The variable-speed drive unit for the work table is housed in the main pedestal and the speed of the work table can be changed by operating a conveniently located handwheel. The moving parts beneath the work table operate in a bath of oil and can be inspected by removing the tray at the operators position. Work up to 12 in. in diameter can be polished or buffed in this machine.

Automatic Riveter Is Semi-Portable

The "Erco" Model 262 semi-portable automatic punching and riveting machine shown, offered by the Engineering & Research Corp., Riverdale, Md., is equipped with a balancing unit for ease in locating the riveting head quickly. This unit has a C-type frame and an 18-in. throat. It will punch holes up to ⅛-in. in diameter through the combined thickness of all layers of material not exceeding 65,000 lb. per sq. in. tensile strength.

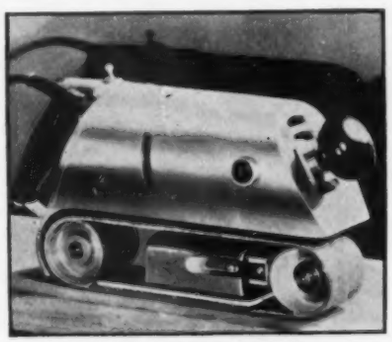


For countersunk rivets, the maximum combined thickness of all layers should not exceed 75 per cent of the rivet shank diameter. Maximum rivet diameter is ⅛ in. and the maximum length of rivet handled is ⅜ in. Rivets are fed to the drum by hand and an air pressure of 90–100 lb. per sq. in. is required for operation of the punching and riveting head.

Static Balancer Has Improved Stem

The Taylor Mfg. Corp., 2330 W. Clybourn St., Milwaukee, Wis., has improved the "Hi-Eff" static universal balancer so that the machine now is adaptable for a wider range of work. This balancer employs the principle of a hardened ball which is free to move on a hardened horizontal plane. The machine's construction locates the ball exactly coincident with the works center of rotation; it is the eccentricity of the location of

the center of gravity of the work with respect to the center of rotation that causes the ball to seek a new position. Heretofore, it has been possible to vary the pendulum arm length only slightly with an adjustable screw at the top of the beam spindle. The improvement in the machine consists of multiple slots in the stem that permits it to be located in any position with respect to the center of gravity of the work piece. Both the upper and lower stem bearings have been enlarged to provide a more rigid mounting, which is of importance in those balancing operations requiring limits of unbalance down to 0.001 in. The machine shown is equipped with a drilling spindle for correcting unbalance and is used for balancing clutch assemblies to a tolerance of 0.3 in. at the rate of 55–60 assemblies per hour.

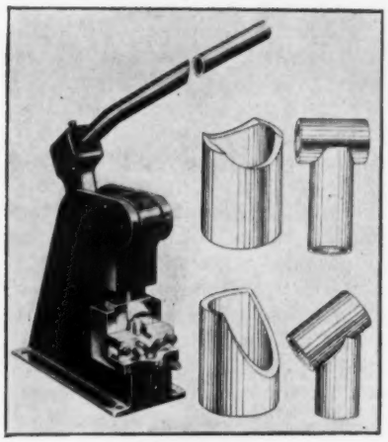


Type A-2 Belt Sander Uses 2-In. Wide Bands

The light-weight of the "Guild Sander" portable electric belt sander developed by the Syracuse Guild Tool Co., Syracuse, N. Y., permits it to be used in almost any position. It is adaptable for standing straight or slightly curved surfaces and the front pulley may be used as a spindle sander. Abrasive belts used are of the endless type and travel 600 ft. per min. They are 2 in. wide and are furnished in all usable grits. The sander is complete with a 110-volt universal motor and weighs 9 lb.

"Arc-Fit" Tool Shears Pipe Ends for Welding

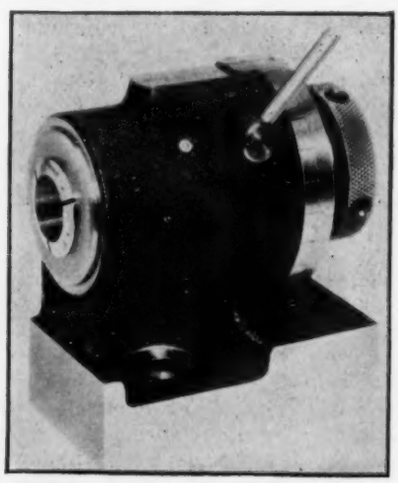
Offered by Dreis & Krump Mfg. Co., 6400 S. Loomis Blvd., Chicago, Ill., the "Arc-Fit" tool is designed to prepare pipe and tube ends for making welded tee, bevel and double tee joints. Pipe or tubing is fed endwise over the top shearing lip die, and the first operation shears out



one-half of the radius. The pipe or tubing then is rotated 180 deg., and the second operation shears out the remaining half of the radius. A different size of tool is used on each different size of pipe. "Arc-Fits" are of a sub-press design and can be used in any punch press having a 7-in. die space and the necessary capacity to perform the shearing operation. Sizes up to that used for 2-in. standard pipe can be mounted in a special hand press as shown. These tools weigh approximately 17 lb. and the hand press weighs 90 lb.

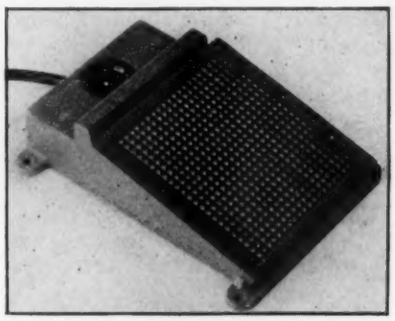
Collet Index Fixture Has 1-In. Capacity

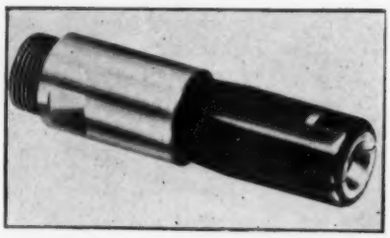
The Model 5-C collet index fixture offered by Hardinge Bros., Inc., Elmira, N. Y., takes standard No. 5-C collets with 1-in. round stock capacity. This fixture also can be furnished to take other standard collets with the same capacity. The fixture can be purchased separately or arranged with a tailstock and sub-base for holding work between centers. A wide range of machining operations, including work on milling machines, grinders, shapers and drill presses, can be facilitated through the use of this fixture. It has a $3\frac{11}{16}$-in. diameter index plate with 24 holes, as regularly furnished, but also can be obtained with index plates having from 2 to 30 holes. The hardened index pin is lever operated.



Foot Control Switch Offered By Leeds

Rated 12 amp. at 125 volts and 6 amp. at 250 volts, this double-pole, single-throw switch announced by The Leeds Electric & Mfg. Co., 1840 Broad St., Hartford, Conn., permits starting or stopping the machine while the operator's hands are free to handle the work on lathes, grinders, saw benches or drill presses. The drive motor will run only while the switch is closed by foot pressure; removal of the foot from the switch will bring the motor to a stop.





Master Feed Fingers Are Adjustable

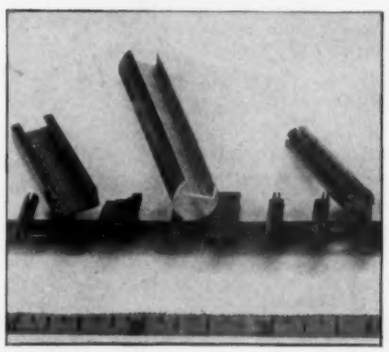
Morrison Machine Products, Inc., Elmira, N. Y., has developed a line of master feed fingers for use with Brown & Sharpe automatic screw machines which require an adjustable tension feed finger because of varying speeds, different types of stock, length of bars and other factors. In this design, the outside sleeve is screwed forward to increase the tension and backward to decrease the tension. When applied to the machine, the feed tube acts as a lock to maintain the predetermined tension. Standard pads are available in hardened steel, nickel cast iron and bronze and are interchangeable in the Style B master feed finger now in use.

Platform Ladder Is Moved On Casters

The Aluminum Ladder Co., 104 Fifth Ave., Tarentum, Pa., has developed a platform-type ladder made of aluminum and equipped with casters on the back legs so that it can be moved easily. Designated as the No. 206 ladder, this unit will support a load of 1,000 lb. and weighs only 43 lb. The platform is 66-in. above the floor and is 22-in. square. Bottom of the ladder measures 28 x 22 in.

Precision Shapes Made in Small Sizes

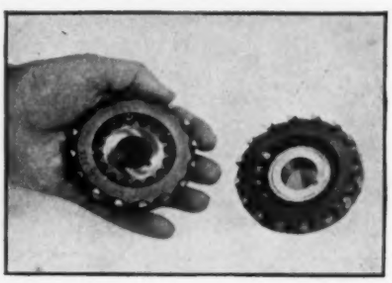
Shapes in many designs and of thin sections now are being made in metals and plastics for instrument makers, scientific workers and industrial plants by Precision Shapes, Inc., 230 Park Ave., New York, N. Y. Standard



designs in brass are kept in stock, but other designs, even when of complicated form, can be made to specifications at short notice in a wide range of materials. With the process used, expense for dies is eliminated. These shapes can be made in any length up to 24 ft. The process is claimed to make possible the meeting of unusual requirements in design; for instance, $\frac{1}{32}$ in. angles with a wall thickness of 0.010 in., $\frac{1}{16}$-in. Tees with a wall thickness of 0.012 in., channels and square channels of the same size, $\frac{1}{16}$ in. thick slotted angles and $\frac{1}{16}$ in. I-beams are among the standard items.

Type L Cutters Use Inserted Blades

Available in two styles for use as shell end mills or half side mills, the Type L milling cutters range in size from $2\frac{1}{2}$ to 5 in. with 10 to 22 inserted blades. Manufactured by the Lovejoy Tool Co., Inc., Springfield, Vt., these cutters are intended for



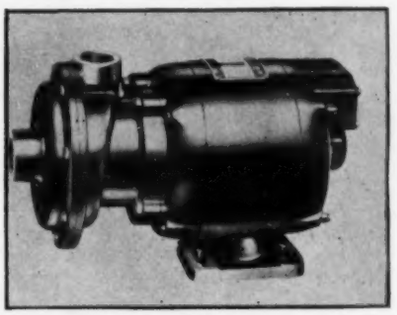
work having a depth of cut of $\frac{3}{16}$ in. or less; although slightly deeper cuts can be taken with medium feeds if the blades are moved out so as to overhang the housing. Only one size and shape of blade is used throughout the series. These blades are locked positively in position and can be adjusted for cutter size.

"Motorpumps" Supply Moderate Flow Volume

The No. 220 and No. 240 centrifugal "Motorpumps" announced by Brown & Sharpe Mfg. Co., Providence, R. I., are suited for supplying coolant for machine tools and for use where dirt or abrasives may be present in the liquid being pumped. These pumps supply a moderate volume of flow at a low head and can be furnished with motors of various electrical characteristics.

The No. 220 pump is designed for operation with the impeller below the liquid level. It can be mounted in practically any position, either horizontally or vertically, but the motor should be above the pump. This pump discharges radially from the center of the rotor assembly, permitting uniform piping and direct flow of the liquid.

Similar to the No. 220 pump, the No. 240 pump has a flange mounting integral with the pump and does not require inlet piping. It is intended for mounting in a vertical position, but can be used in a horizontal position if required. Discharge port of this pump can be shifted to any 45 deg. angle with the intake or suction.



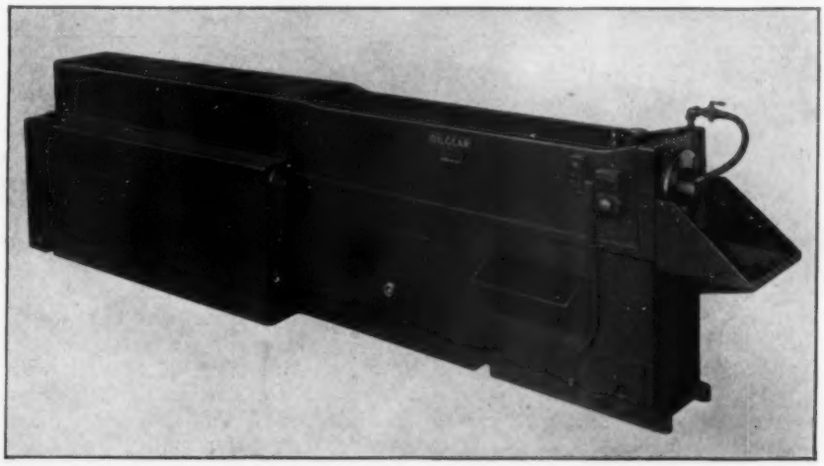
The No. 220 centrifugal pump offered by Brown & Sharpe can be mounted in practically any position, either horizontally or vertically

Designed for flange mounting, the No. 240 pump is intended for mounting in a vertical position

Type XL Broaching Machines Offered by Oilgear

The Oilgear Co., 1319 W. Bruce St., Milwaukee, Wis., has announced improvements in the comprehensive line of Type XL horizontal broaching machines, which are adapted for both internal and external broaching operations. Nine standard sizes, in capacities ranging from 6,000 to 100,000 lb. normal broaching capacity, are available. Working strokes range from 36 to 72 in. Each machine is equipped with a Type DX two-way variable displacement heavy duty radial piston pump of sufficient capacity to provide variable cutting speeds up to 37 ft. per min. and independently variable return speeds up to 100 ft. per min. Two convenient adjustable dogs with needle bearing rollers are mounted on a rotary acting control rod in the broach trough so that any requirement as to working stroke or start and stop position of the crosshead can be met.

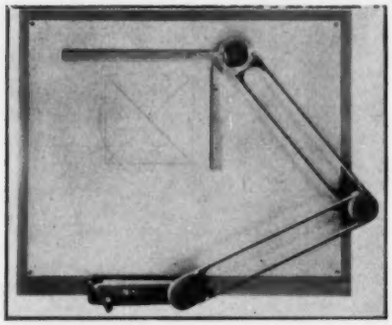
Push button control is provided for each machine. Positive emergency stop at any time is assured by depressing a large raised mushroom button. An alternative toe lever switch also controls the crosshead motion,



thus leaving both of the operator's hands free to handle the work and the tool. Conventional control valves, levers, links, rods, springs, detents and pins have been eliminated. Standard equipment on each machine consists of an all steel welded frame which supports the trough, cylinder, pump, motor and coolant pump, and contains ample reservoirs for the oil in the hydraulic system and for tool coolant. For supporting long tools, a trough which is bolted to the sides of the face plate is provided.

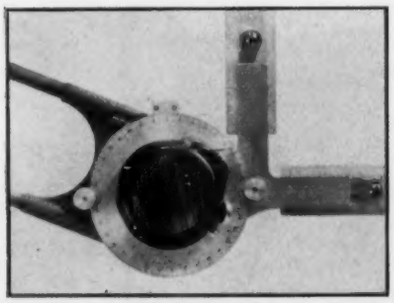
Drafting Machine Is Easily Set

An arm completely enclosing bands and working parts constitutes a major improvement in the Model 77 universal drafting machine now offered by the Universal Drafting Machine Co., Cleveland, Ohio. Such enclosure



Both the protractor and the arm of the Model 77 drafting machine are light in weight, making possible easy setting of the unit

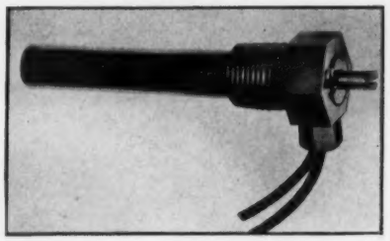
minimizes accumulation of dirt between the bands and wheels and protects the draftsman. An improvement of equal importance is the full-vision protractor, located entirely above the arm, giving unrestricted vision and greater convenience of operation and control. A secondary 360 deg. protractor movement has been added to make possible the setting of the protractor to any angle on the drawing. Then, from the new baseline, the 30, 45, 60 and 90 deg. stops can be used, or any graduation read directly. This secondary 360 deg. rotating element is operated by two thumbscrews.



The full-vision protractor of this drafting machine is locked with two thumbscrews. The protractor can be set to any baseline

"Thermoswitch" Has Wide Adjustment

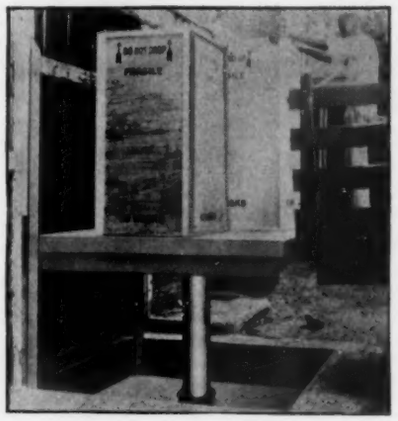
The adjustable operating range of the "Hex Head" Thermoswitch offered by Fenwal, Inc., Ashland, Mass., is —50 to 400 F. These switches are



available in two types, in one type the contacts open on an increase in temperature an din the other the contacts open on a decrease in temperature. The No. 732 RH switch shown changes adjustment 80 F. per full turn of screw, while the No. 741 RH switch available on special order, changes adjustment 20 F. per full term.

"DataTule" Contains Several Useful Tables

The "DataTule" pocket reminder announced by DataTule Co., 89 State St., Boston, Mass., contains useful tables of tapers per foot, tapers per inch, angle with center line and included angle for a number of standard tapers. Also included are data on standard pipe, U. S. and Acme threads, sizes of round stock necessary to make hexagons and squares, and a table of decimal equivalents. These data are in white letters and figures on a black background. Turning a handle at the end of the instrument brings each succeeding line into position in front of a reading slot in the case. This case measures 3x1¼x⅛ in.

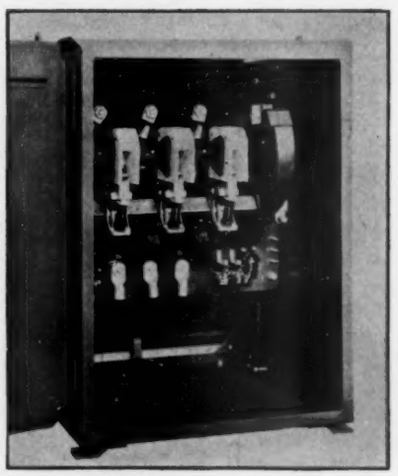


"Oildraulic" Lifts Have Many Uses

Designed to form a part of the floor or loading platform when not in use, the "Oildraulic" elevators announced by the Rotary Lift Co., Memphis, Tenn., are powered by a seven cylinder radial pump which is claimed to be efficient at high pressures, permitting the use of a small-diameter well hole. These units can be controlled by hand lever at the power unit, by pull rope, or by pushbuttons conveniently located.

New Linestarters Are Non-Reversing

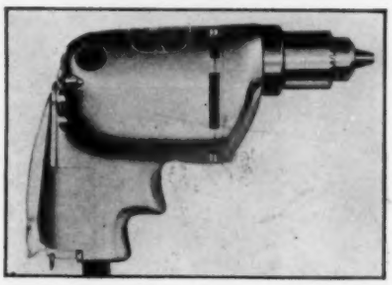
Class 11-200-G non-reversing linestarters for squirrel-cage and wound-rotor a.c. motors are made in 300,



600, 750 and 1,200 amp. ratings, two or three phase, three wire, by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Features of these switches are: low-voltage protection or release through a low-voltage relay; bimetallic overload relay; hand or automatic reset; saturated current transformers to insure adequate protection on slow starting applications; and magnetic blowouts to insure adequate arc-rupturing capacity.

3/16 In. Hornet Drill Is Light In Weight

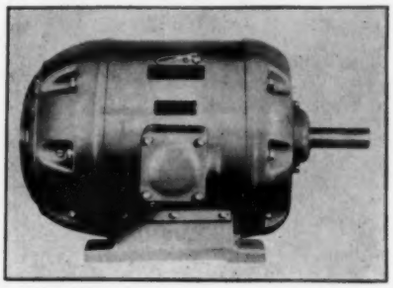
The Van Dorn Electric Tool Co., Towson, Md., has added the lightweight $\frac{3}{16}$-in capacity "Hornet" drill to its line of portable electric tools. This tool is said to be suitable for



continuous production work and is recommended especially for aircraft and light industrial operations.

Streamlined Motors Are Explosion-Proof

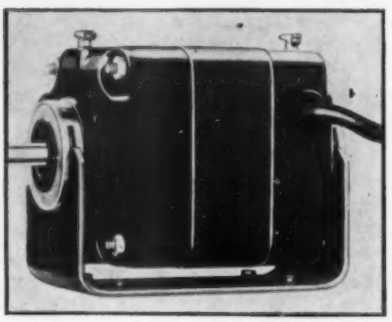
A number of major mechanical and electrical improvements are incorporated in a line of "Streamlined" explosion-proof electric motors announced by the Louis Allis Co., 133 E. Stewart St., Milwaukee, Wis. These motors are said to be satisfactory for use in any Class 1, Group



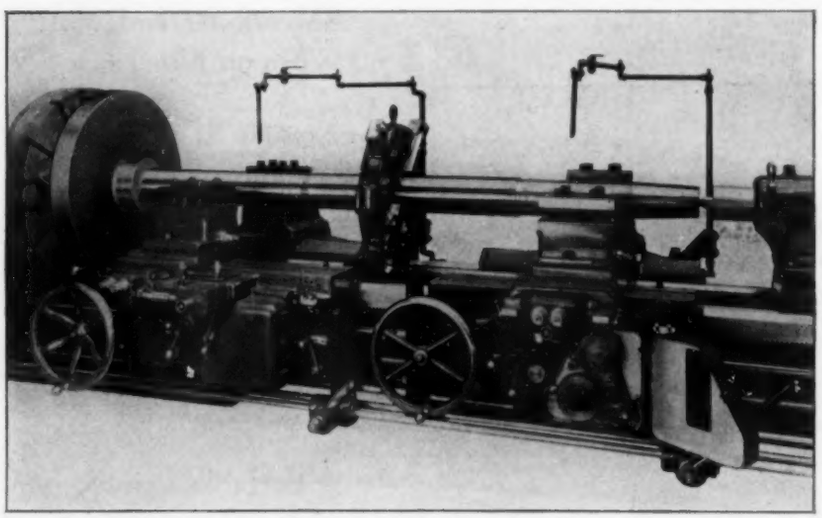
D explosive atmospheres. Cartridge-type ball bearings are used and the bearing caps are so designed as to permit the operator to easily inspect the bearings without removing the end bells. Fans used in these motors are made of a high-tensile strength aluminum alloy. These motors are built to N.E.M.A. standards and are interchangeable with corresponding N.E.M.A. frame sizes of other types of motors, both a.c. and d.c.

Improved Motors Have Small Size

These square small-power electric motors offered by the Ohio Electric Mfg. Co., 5914 Maurice Ave., Cleveland, Ohio, may be wound for shaded pole or permanent split-capacitor operation. The motor measures 3.75 in. square by 4.75 in. long. Extension



of the $\frac{3}{8}$ in. diameter shaft is 1.25 in. The motor can be supplied to mount in any desired position or with a resilient base, as shown. When wound for shaded pole operation, these motors have capacities ranging from 1/200 to 1/80 hp. The permanent split capacitor types are claimed to be twice as efficient as the shaded pole types and are made in sizes ranging from 1/150 to 1/20 hp.



"American" Taper Unit Has Geared Mechanism

The American Tool Works Co., Cincinnati, Ohio, has developed a geared taper turning mechanism for application to "Super-Productive" lathes so that tapers can be turned within a moderate range of diameter on any length of work up to the full center distance capacity of the lathe. With this mechanism, the taper on the work is produced by the simultaneous functioning of the longitudinal and the cross feeding mechanisms, the various degrees or rates of taper being determined by the relation of the length of the carriage travel to the rate of cross feed of the tool slide. The cross feed rate is determined by a series of change gears mounted on a suitable quadrant in the apron.

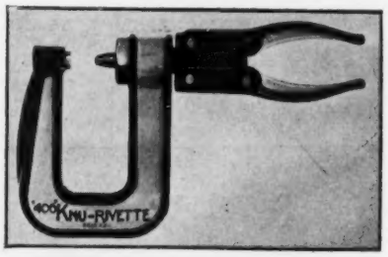
Belt Cutter Provides Square Belt Ends

The "Universal" belt cutter announced by Armstrong-Bray & Co., 308–310 N. Loomis St., Chicago, Ill., will cut leather, fabric and rubber belts up to 8-in. wide. This cutter holds the belt securely against a side guide while a special knife is drawn

down a track that assures an accurate square cut. The track also prevents the knife from slipping and injuring the operator.

No. 400 Riveter Has Detachable Yoke

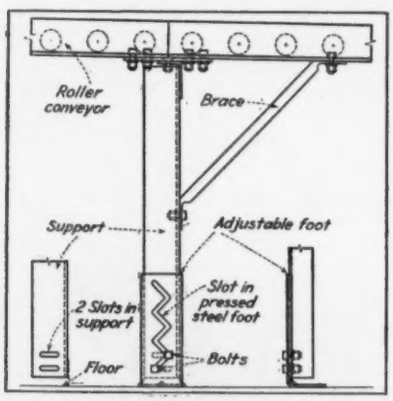
The No. 400 riveting tool offered by Knu-Vise Products Co., Inc., 6430 Cass Ave., Detroit, Mich., incorporates a detachable yoke which allows for the substitution of larger or



smaller sizes at will. Relative distance between the punch and die, or the two anvils, is adjusted by unscrewing the toggle unit to suit and then locking it in place with the jam nut. Working in conjunction with a plunger, the combination of links incorporated in the design of this tool generates sufficient pressure to pierce $\frac{3}{8}$-in. diameter holes in 0.062 in. thick sheet steel, or cold head $\frac{5}{32}$-in. diameter aluminum aircraft rivets.

Conveyor Support Is Adjustable

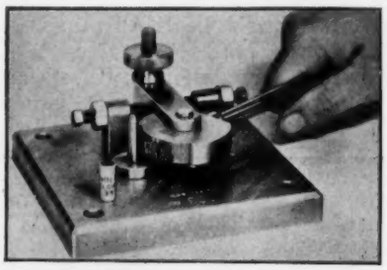
The zig-zag slot in the adjustable foot portion of this conveyor floor support offered by Logan Co., Louisville, Ky., is claimed to prevent slip-



ping under heavy loads. It is not necessary for the holding bolts to be drawn up tight in order to insure against slipping. Height adjustments are made easily.

No. 921 Hand Marker Is Widely Adaptable

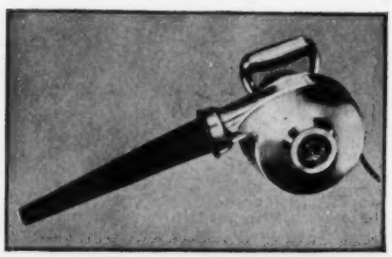
H. O. Bates, 251-257 N. Broad St., Elizabeth, N. J., has announced the development of the No. 921 hand



marking machine for marking metal ferrules, rings, tubes and other cylindrical or tubular parts made of steel, brass, aluminum, nickel, silver, gold, celluloid, mica or bakelite materials. The machine will roll a mark into these materials up to $1\frac{1}{4}$ in. long by $\frac{1}{2}$ in. top to bottom. In marking, the part is rotated and the entire circumference of the part can be marked providing this number does not exceed the $1\frac{1}{2}$ in. marking limit.

Portable Blower Has Two Speeds

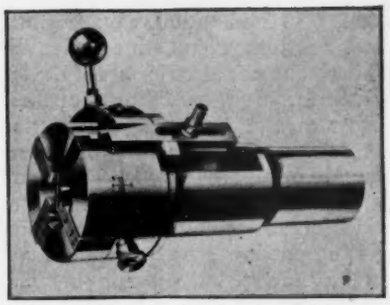
The "Airmaster" portable electric blower announced by Skilsaw, Inc., 230 N. Michigan Ave., Chicago, Ill., combines a high speed and a low speed blower in one all-purpose tool. This blower develops a velocity of 20,500 and 26,000 lineal ft. per



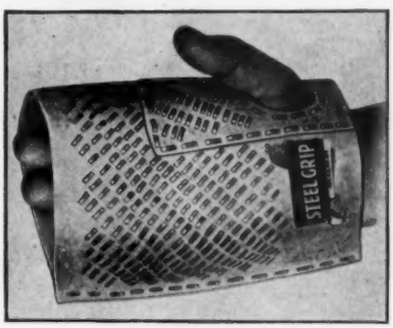
min. with a capacity of 125 and $175\frac{1}{2}$ cu.ft. per min., and a water lift of 36 and 48 in. static pressure. A suction cleaner and a spray unit are standard attachments.

Style CT Die Heads Will Thread Tapers

The Geometric Tool Co., New Haven, Conn., offers the Style CT taper cutting die head for use on hand-operated machines, such as screw machines and turret lathes, where a stationary die head can be



employed. The chasers used in these die heads cut a taper thread in the same manner that a conventional die head cuts a straight thread. It is said that greater lengths of taper can be cut without the use of projection chasers and the length of taper is not limited to the height of the chaser as is the case with a jam cut when chasing tapered threads with a conventional die head. Nine stock sizes offer a threading range of from $\frac{1}{4}$ to 6 in. in large end diameters, or from $\frac{1}{8}$ to 5 in. pipe.



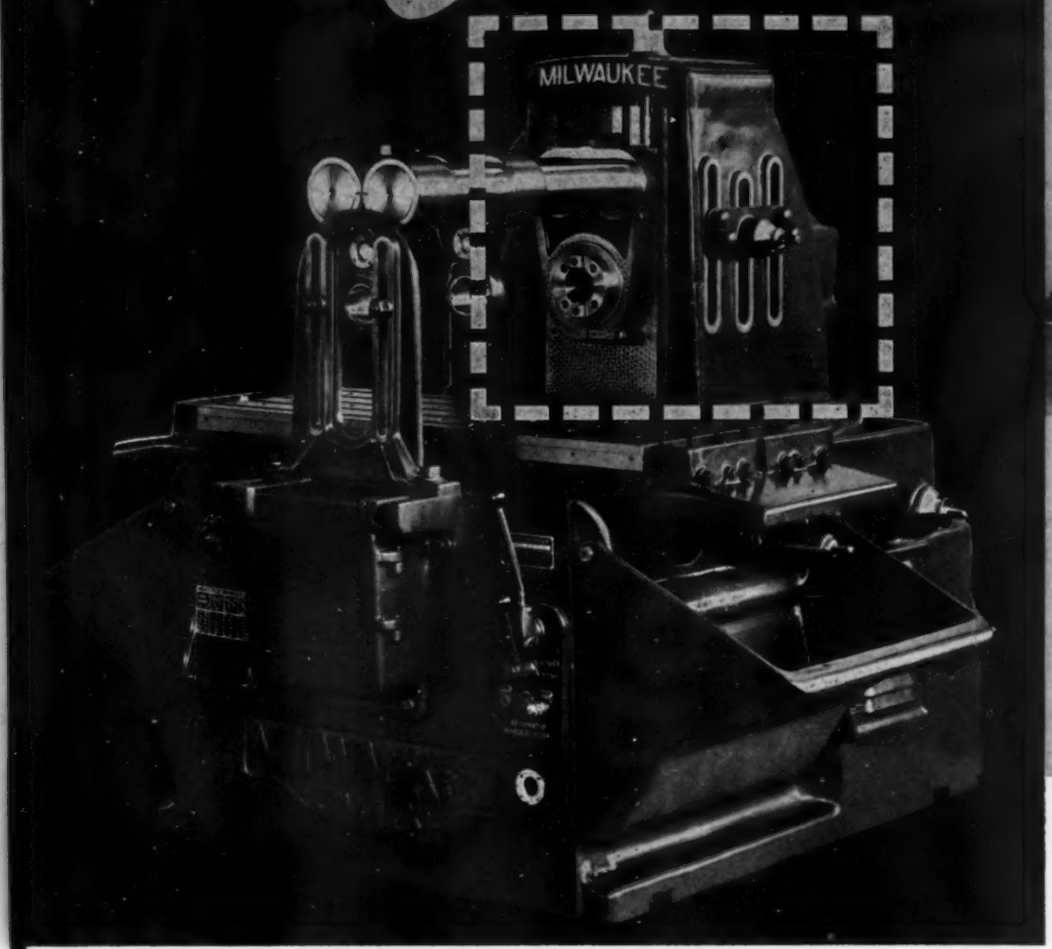
Reversible Handguard Worn on Either Hand

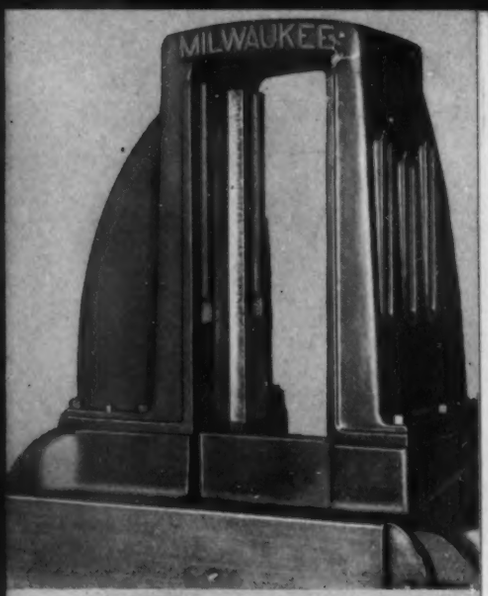
A reversible chrome leather handguard, which fits either hand, has been placed on the market by the Industrial Gloves Co., 721 Garfield Blvd., Danville, Ill. Designated as No. 12237, this guard has steel ribbons placed diagonally on wearing surfaces to give the greatest protection against sharp cutting edges of objects handled. The guard is 7 in. long and may be worn in connection with a cotton glove or over the bare hand as preferred.

Portable Printer Makes Contact Prints

The Keene Appliance Co., 201 First National Bldg., Ann Arbor, Mich., is marketing a portable printer for duplicating tracings, drawings, charts, reports, letters, maps and similar data. Using a special sensitized paper, it makes positive contact prints up to 12 x 18 in. in size. Approximately

LONGER *Cutter* LIFE





Straddle mounting of the spindle block—an example of sound engineering—eliminates over-hang.

Mounting the solid spindle block between two uprights — the flywheel type of spindle drive — adjustable quill support tying over-arms and quill into one unit — center bearing spindle construction — assure rigidity and smoother, longer cutter life on K & T Milwaukee Simplex and Duplex Milling Machines.

KEARNEY & TRECKER CORPORATION
WEST ALLIS STATION MILWAUKEE, WIS., U. S. A.

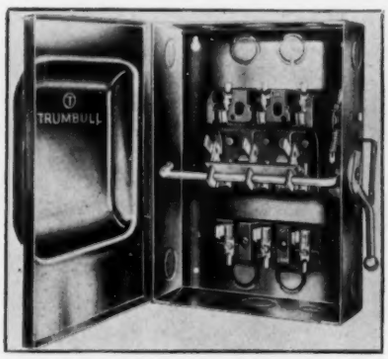
MORE THAN *40 years* OF DOING ONE THING WELL

K&T *Milwaukee* MILLING MACHINES

5 min. are required to expose and develop the print, dry and ready for use. The printer measures 22x16x11 in., and weighs less than 33 lb.

Inclosed Switches Provide Wiring Room

Improved Type C inclosed switches offered by the Trumbull Electric Mfg. Co., Plainville, Conn., are assembled



on heavy porcelain bases in a more compact design with ample wiring room. These switches are available in 30 and 60 amp. capacities.

Micro Switch Has Roller Leaf Spring

A roller leaf spring actuated "Micro Switch" for application where small moving power is available to make or break circuits and where roller action is needed between the cam and the switch lever has been developed by Micro Switch Corp., Free-

port, Ill. The switch measures 2½ in. long, 1⅝ in. high and ¾ in. wide. It will handle ½ hp. This switch is of single pole construction and can be obtained with normally open, normally closed, or double throw contacts. The leaf spring is of stainless steel and the ⅜ in. roller is hardened.

New Indicators Are Sensitive to 0.00001 In.

Sensitive to 0.00001 in., four jeweled indicators offered by B. C. Ames Co., Waltham, Mass., use carbide tipped contact points, as these indicators are so sensitive that slight wear at the point end will alter dial readings. These indicators have a spindle travel of 0.020 in. when supplied with a no-counting dial and can be provided with spindle travel of 0.100 to 0.500 in. when arranged with counting dials.

Type M Dispenser Is Operated Easily

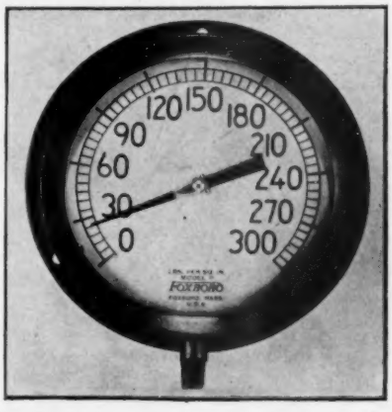
"Pax" Type M dispensers for hand soaps are designed to deliver the proper amount of soap into the hand that operates the feed bar. Offered by the G. H. Packwood Mfg. Co., St. Louis, Mo., these dispensers are easily installed and refilled.

Recording Instruments Have Inkless Mechanism

Continuous accurate operation for 30 days without attention, at temperatures as low as 10 F. and as high as 120 F., is said to be possible with the Type CF-1 line of inkless recording a.c. ammeters and voltmeters announced by the General Electric Co., Schenectady, N. Y. These instruments are made in both single- and double-range models. A typewriter ribbon is used in the inkless mechanism to make a record by a series of dots.

Foxboro Model P Gage Is All-Welded

The all-welded steel construction of the Model P indicating gage announced by the Foxboro Co., Foxboro, Mass., is claimed to provide protection on applications where there are fumes or vapors corrosive to bronze. A special Chapmanized steel is employed in the pinion, segment, arbor and connecting link of the gage. Movement plates, columns, links and shoulder screws are made of stainless steel. Three types are available. The Model P test gage, available in ranges from 0–15 to 0–10,000 lb. is guaranteed to be accurate within 0.5 per cent at any point



A GREAT STEP FORWARD IN A FORWARD STEPPING INDUSTRY

With a capacity up to 1½" solid stock, spindle and gears mounted in anti-friction bearings and many other mechanical features found only in larger machines, the new "RAPIDUCTION JUNIOR" is a great step forward in the threading industry.

The "RAPIDUCTION JUNIOR" is so constructed that with die-head and carriage removed it can be adapted to chamfering, drilling, reaming, boring, tapping and many other jobs.

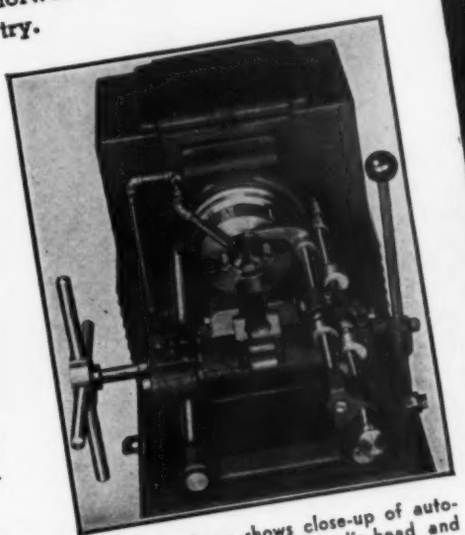


Illustration above shows close-up of automatic opening and closing die-head and stock-stop; open type, quick-centering vise; feed lever and rigidly supported ways on which carriage is mounted.

Investigate the "RAPIDUCTION JUNIOR" as a means of reducing your threading costs at the lowest possible initial investment. Get details and specifications today, from—

THE OSTER MANUFACTURING COMPANY

Sales office: 2049 East 61st Street, Cleveland, Ohio
Factories — Erie, Penna., and Cleveland, Ohio
New York City Office, 30 Church St.
Philadelphia Office, 111 No. 3rd St.

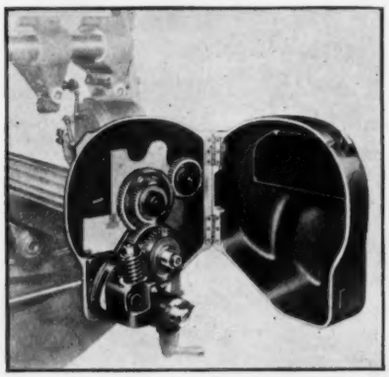
Threading Headquarters Since 1893

OSTER
THREADING EQUIPMENT
WILLIAMS

on the range and the Model P hydraulic gage has ranges from 0–600 to 0–10,000 lb.

No. 20 Attachment Provides Short Leads

Shorter leads than can be cut when using gears regularly furnished with universal index centers can be obtained through the application of the No. 20 short lead and feed reducing



attachment developed by Brown & Sharpe Mfg. Co., Providence, R. I. Arranged for use on No. 2 "Light Type" universal milling machines, this attachment will permit the cutting of leads as short as 0.01250 in. Used as a feed reducer, change gears provide longitudinal feeds of 1/20, 1/200 and 1/400 of the normal rate of table feed. Net weight of the attachment is about 85 lb.

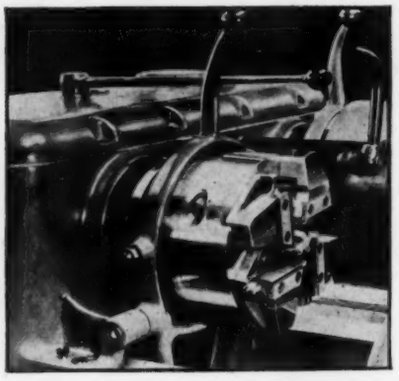
Series 2800 Timers Are Vernier-Set

Vernier-set Series 2800 timers, offered by Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia, Pa., provide accurate and visible timing adjustment to within a split scale division. The de-

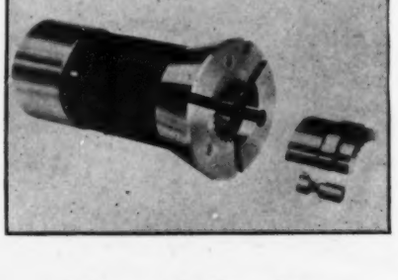
sired adjustment is maintained without a locking device. Four arrangements of load circuits are possible. These timers are especially adapted to applications on automatic machinery, to molding and extrusion presses, to the purging of gas fired ovens, and to the timing of furnace operation.

Semi-Receding Head Cuts Tapered Threads

A semi-receding threading head has been developed by Landis Machine Co., Inc., Waynesboro, Pa., for cutting tapered threads. This head incorporates an operating mechanism which is designed so that as the die head advances under cut the end of

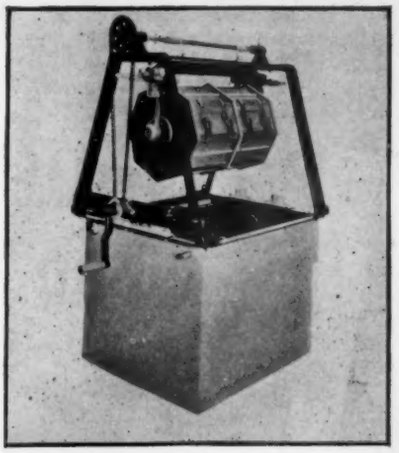


the work will contact the reamer to cause the chasers to recede to produce a tapered thread. This receding action does not commence until after the first two or three threads are formed. The reamer establishes the total thread length.



Master Collets Use Self-Locking Pads

A line of master collets and pads which are claimed to give solid collet performance has been announced by Morrison Machine Products, Inc., Elmira, N. Y. Pads in these collets can be changed without removing the master collet from the spindle of the machine. Each pad is located in position with a stud screw having right and left hand threads operating jaws for a dovetail grip on the pad. The lock centrally draws the outside diameter of the pad firmly against the inside diameter of the collet to assure accuracy.

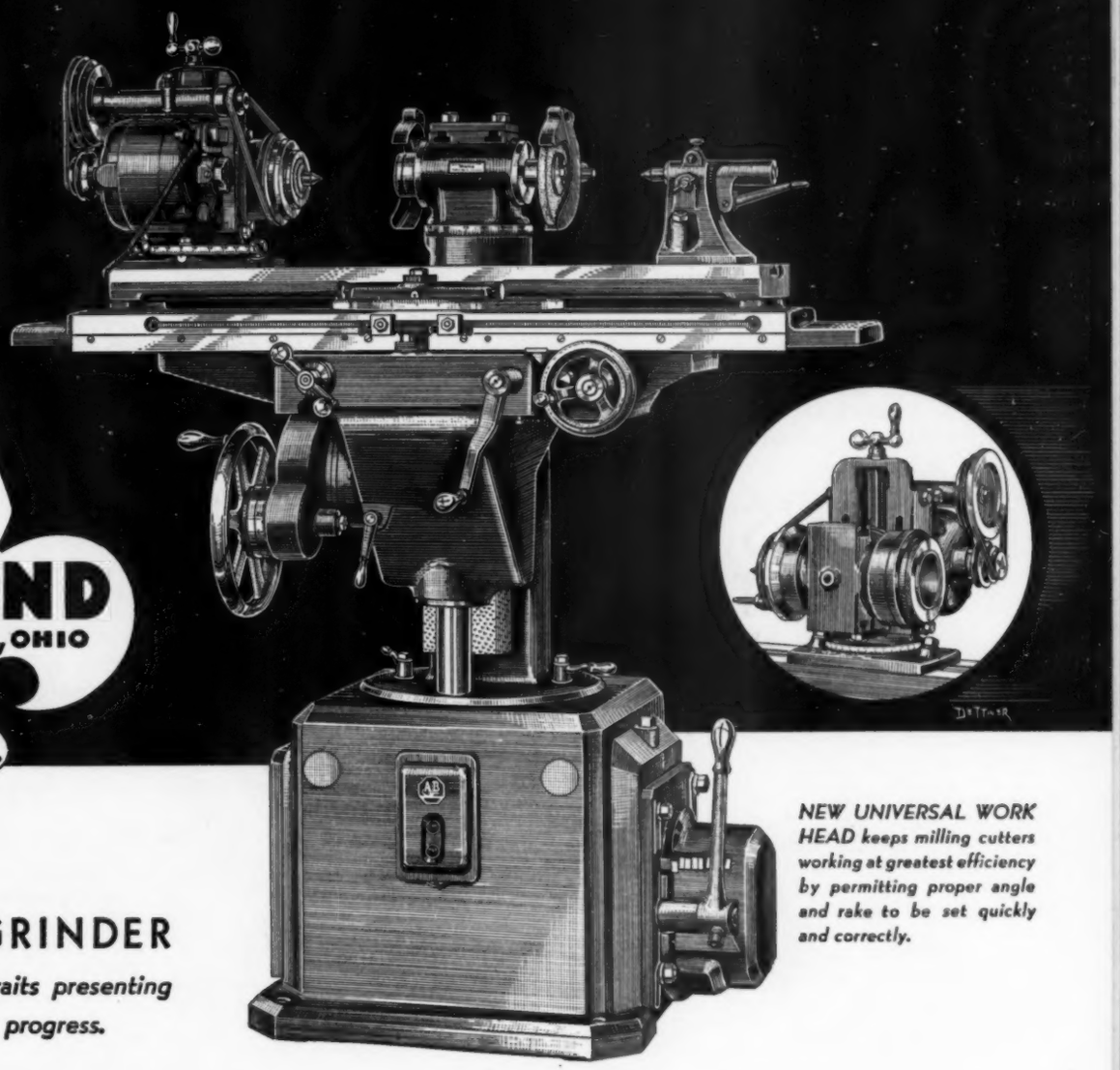


Plating Barrel Hoist Is Hand-Operated

The "Mercil" hand-operated hoist, developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J., for single cylinder plating barrels has a 3 to 1 ratio which requires about 15 turns to lift a 14 in. diameter barrel and about 17 turns to lift a 20 in. barrel. This hoist consists of an iron framework on top of which are two brackets with bronze bushings, carrying a 1¼ in. diameter shaft. A ¼ in. diameter wire cable is wound around this shaft. Drive for this shaft is removable so that it can be mounted on either end of the framework.

A.C. Time Totalizer Measure "On" Time

The Production Instrument Co., 702–6 W. Jackson Blvd., Chicago, Ill., is offering the "Time Totalizer" for automatically measuring the "on time" of a.c. circuits. This instrument consists of number wheels geared to a synchronous motor so



LeBLOND
CINCINNATI, OHIO
U.S.A.

NEW UNIVERSAL WORK HEAD keeps milling cutters working at greatest efficiency by permitting proper angle and rake to be set quickly and correctly.

No. 2 CUTTER GRINDER

No. 4 in a series of pen portraits presenting the tools that serve production progress.

A modern production tool of wide range versatility, flexibility and precision . . . designed to meet the most comprehensive needs of the tool room.

No. 2 Cutter Grinder will hold permanent, precision alignment due to its perfect structural balance, absence of stems, posts, split bearings and with but few wearing parts—while its accessibility and speed of set-up provides an operating tool that sets a high standard of cutter grinder efficiency. Important features are:

NEW WORK HEAD: Takes B. & S. and National Standard tapers, allowing milling cutters to be sharpened on their own arbors. Has complete Universal movement in two planes with vertical adjustment of 3½ inches. Quick setting for correct clearance angle and rake, an important essential for long life of cutters.

SELECTIVE SPEEDS TO WHEEL SPINDLE, with 4-speed transmission. Speeds of 3100, 4000, 5100 and 6500 R. P. M. suitable for any size and grade of grinding wheel, quickly obtained. Smooth, silent, vibrationless drive.

ANTI-FRICTION MOUNTED TABLE: Extreme ease of operation and less operator fatigue made possible by finger-touch control. Also furnished with power feed.

SWIVEL TABLE: Fine micrometer adjustment through range of 180 degree arc.

SHAFTS AND FEED SCREW: Mounted on anti friction, dust sealed bearings.

DUST FREE MOTOR: Entirely sealed from dust by unique construction of base, column and wheel head.

FRONT AND REAR CONTROLS: Permit operation from any position.

A complete set of attachments for Internal, Cylindrical, Surface, Gear Cutter Teeth Grinding, etc., are available, which provide added facilities for specialized cutter grinder and sharpening work.

Tool rooms to whom faster sharpening, operating efficiency and wide range capacity means lower grinding and sharpening costs — should write at once for special detailed Bulletin No. 2 CG. Address THE R. K. LeBLOND MACHINE TOOL CO., DEPT. H-20, CINCINNATI, OHIO.

that they record time in hours and tenths of hours. When connected in parallel with a motor, lighting circuit or other a.c. circuit, the instrument automatically accumulates the total "on time." It is inclosed in a dust proof case.

No. 23 Plain Grinder Added to B&S Series

The electrically-controlled No. 23 plain cylindrical grinder announced by Brown & Sharpe Mfg. Co., Providence, R. I., is similar in design to the No. 20 and No. 22 grinders previously described (*AM*—Vol. 82, page 129), but has 48 in. capacity between centers. Work 10¾ in. in diameter can be swung on centers over the table and a 24-in. wheel clears work to 10 in. in diameter. Wheel spindle, headstock, table, lubricating pump and coolant pump have individual motor drives, the wheel spindle being driven by multiple V-belts from a motor mounted on the wheel slide. All other drives are direct-connected. Wheel speeds of 825 and 1,035 r.p.m. are provided for 30 and 24 in. wheels respectively by changing the wheel spindle sheave. Work speeds are variable between 80 and 320 r.p.m.

Selector switches and controls provide for (1) power travel with handwheel automatically disengaged; (2) automatic throughout of power longitudinal travel and engagement of handwheel at the end of table traverse; (3) choice of fast or slow hand travel; and (4) table movements of 7, 11 and 15 in. per min. for wheel truing. Table travel is variable between 15 and 300 in. per min. in two series. Three types of cross feed are available, selected by a control knob, as follows: (1) automatic, for feeding the wheel to the work with the table traversing; (2) independent automatic, for feeding the wheel to the work with the table stationary; and (3) hand feed against a positive stop. Table can be set at an angle to the ways for grinding tapers. Floor space required, 75 x 152¼ in.; net weight, 10,000 lb.

Plating Tank Has Built-In Exhaust Ducts

An improved plating barrel tank designed especially for hot solutions by the Hanson-Van Winkle-Munning Co., Matawan, N. J., employs a series of small ducts for exhausting the fumes. A series of these ducts directly over the anode rods are connected with the main duct on the side. These individual ducts do not interfere with the placement of the cylinders into the tank in their respective saddle brackets, nor do they leave any cumbersome ducts along the side or above the tanks.

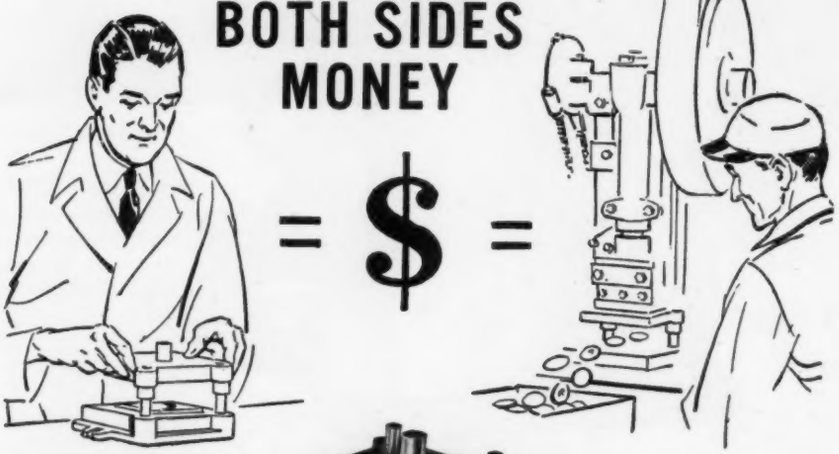
New Rotary Files Have Ground Teeth

The Grobet File Corp. of America, 3 Park Place, New York, N. Y., have added a line of high speed steel rotary files which are ground from the solid after hardening. The advantage claimed for these files is that they can be resharpened repeatedly at a low cost. These files are illustrated in Catalog No. G-22.

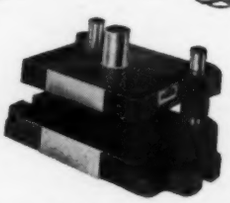
Castable Refractory Makes Special Shapes

Suitable for working temperatures up to 2200 F., the lightweight "Firecrete" castable refractory announced by Johns-Manville Co., 22 E. 40th St., New York, N. Y., can be used to form any required refractory shape for replacing difficult brick construc-

IT'S A GOOD DEAL
THAT SAVES BOTH SIDES MONEY



Die Makers know that Danly Die Sets are accurate in every dimension—there are no added, unpaid costs for further machining, or truing up—no lost time in trying and fitting in mounting the die.



Die Users know that dies mounted in Danly Die Sets give them lower cost stamping in freedom from shearing—accurate and faster production—longer runs between regrinds—and more stampings per die.

DIE BUYERS—Specify Danly Die Sets for Your Dies
DIE MAKERS—Include Danly Die Sets in Your Estimates
It will be good business for you both

DANLY MACHINE SPECIALTIES, Inc., 2112 So. 52nd Ave., Chicago, Ill.

DANLY DIE SETS AND DIE MAKERS' SUPPLIES FROM THE 8 DANLY BRANCH OFFICE STOCKS

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CLEVELAND, OHIO 1745 ROCKWELL AVENUE
DAYTON, OHIO 990 E. MONUMENT AVENUE
PHILADELPHIA, PA. 3913 N. BROAD STREET
ROCHESTER, N. Y. 16 COMMERCIAL STREET
MILWAUKEE, WIS. 513 EAST BUFFALO STREET

DANLY DIE SETS and DIE MAKERS' SUPPLIES

Their Dependable Quality Means Lower Cost Stampings

tion, for lining furnace doors, and for making small monolithic linings. This material is claimed to be four times as effective as firebrick in retarding heat, while having only half its weight. Also, its resistance to spalling is such that it will withstand direct exposure to flame temperatures. Shapes are made by mixing the "Firecrete" with water and casting it into a form; 24 hr. later the shape is ready to be placed in service.

Heavy-Duty Bench Uses ⅜-In. Plate

A heavy-duty steel work bench placed on the market by Pollard Bros. Mfg. Co., 5503 Northwest Highway, Chicago, Ill., has a top made from ⅜-in. thick steel plate, which is bolted to standard heavy-duty bench legs. These benches are made in two standard widths of 24 and 30 in., and in lengths of 3, 4, 5, and 6 ft. All of these benches can be equipped with steel drawers.

TRADE PUBLICATIONS

ALLOY STEEL Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill., has published a bulletin describing "Ry" oil-hardening steel.

BOLTS The 1939 catalog of the H. M. Harper Co., 2620 Fletcher St., Chicago, Ill., lists approximately 3600 non-ferrous and stainless steel nuts, bolts, screws and accessories.

BROACHING Circular No. 509, now being distributed by the Foote-Burt Co., Cleveland, Ohio, contains eight pages describing and illustrating the No. 10D duplex surface broaching machine.

BRONZE The 1939 catalog No. 390, of the Johnson Bronze Co., New Castle, Pa., provides 72 pages of specifications covering general purpose sleeve bearings, bronze bushings, solid and cored machined bars, cast bronze graphite bearings and fittings.

CRANES Bulletin No. C-6, issued by the Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis., covers the design and application of the "P&H" line of industrial cranes ranging in capacity from 3 to 300 tons.

CUTTING FLUID E. F. Houghton & Co., Third, 240 W. Somerset St., Philadelphia, Pa., has issued an illustrated folder discussing properties of the "Cut-Max Base No. 7".

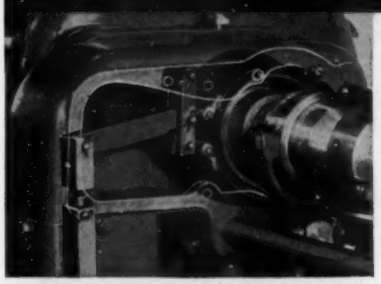
DIAL INDICATORS. Federal Products Corp., 1144 Eddy St., Providence, R. I., provides features, descriptions and general specifications of a complete line of precision dial indicators and accessories in its 64-page illustrated Catalog No. 38.

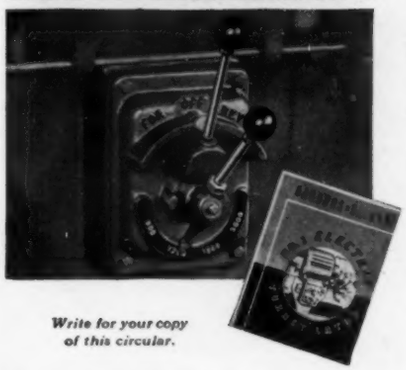
DIAMOND DRESSERS "Unsung Heroes of Industry" includes lively limericks, clever cartoons illustrating intelligent insight into pesky problems presented production personnel. In back is a discussion of "Koebelite" Diamond Tools. Released by the Koebel Diamond Tool Co., 1200 Oakman Blvd., Detroit, Mich.

DIE HEADS Bulletin No. F-80-3, issued by the Landis Machine Co., Waynesboro, Pa., provides detailed specifications of several types of hardened and ground die heads.

ELECTRIC HEATING A series of leaflets issued by the Harold E. Trent Co., 618 N. 54th St., Philadelphia, Pa., describes a line of industrial heating equipment. Leaflet No. 26-TC

BARDONS & OLIVER





Write for your copy of this circular.

HERE ARE 5 REASONS WHY THE No. 1 ELECTRIC TURRET LATHE delivers high production at low cost

INSTANT STARTING—merely move control lever to the left.

QUICK REVERSING—immediately responsive to movement of control lever to right.

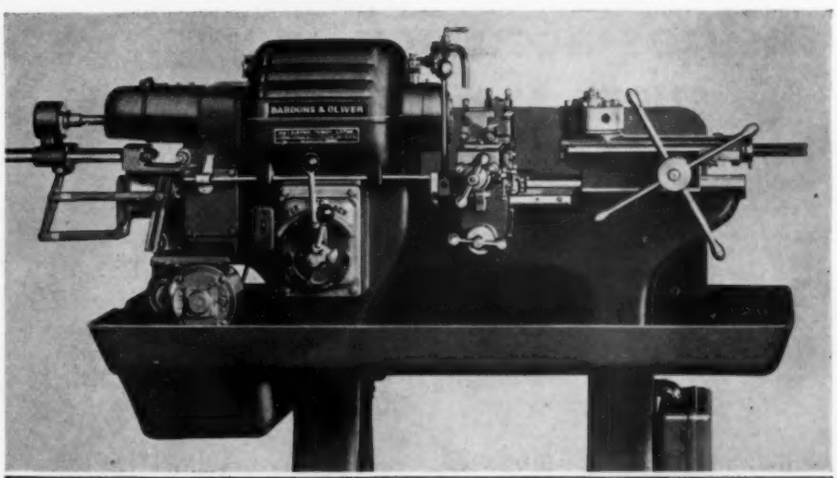
FOUR SPEED CHANGES—at the tips of your fingers by the short speed change lever.

POWERFUL ELECTRIC BRAKING—by gentle pressure on control lever in the neutral position.

POWER FEEDING AND GRIPPING OF BAR—controlled either by the cross slide lever or by trigger on head end bracket.

We build a complete line of ram type turret lathes.

This is one of a series of advertisements featuring recent developments in Bardons & Oliver Turret Lathes.



BARDONS & OLIVER, INC.
1133 W. 9TH ST. . . CLEVELAND, OHIO

discusses features of a line of electric furnaces, No. 30-TE provides specifications of electric vane strip heaters, while No. 30-TF gives data concerning several types of unit electric heaters.

ELECTRODE A.c. crucible-weld electrodes are described in data sheet No. 26–650 issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

ENGINES Worthington Pump & Machinery Corp., Harrison, N. J., describes in Bulletin No. F-500-B36 the new Type CC totally inclosed direct injection diesel engines for heavy-duty service.

EYESHIELDS Features of a line of eyeshields for many industrial uses are included in a folder issued by the Jackson Electrode Holder Co., 15122 Mack Ave., Detroit, Mich.

FLEXIBLE TUBING Characteristics of "Resistoflex PVA" flexible tubing, said to be impervious to oils and organic solvents, are discussed in a leaflet issued by the Resistoflex Corp., 370 Lexington Ave., New York.

Where precision counts

WRIGHT AERONAUTICAL

insures accuracy . . . with a

SUPER-SERVICE RADIAL

• For 7 years this Super-Service Radial has produced fast and accurate work in the plant of the WRIGHT AERONAUTICAL CORPORATION, Paterson, N. J. The job being handled is a rear accessory section of cast magnesium alloy for the 1000 H.P. WRIGHT Cyclone Engine.

Centralized control in the head—rapid power traverse—long spindle sleeve bearing at the bottom of the head—herringbone gears for the slow speed spindle drive—provide an ability to take heavy cuts without chatter and are just a few of the reasons why Super-Service Radials produce accurately and at low cost.

Write for catalogs giving complete information.

CINCINNATI BICKFORD TOOL CO. OAKLEY, CINCINNATI, OHIO

CINCINNATI BICKFORD

FLOORING A folder describing "Monocork," a plastic floor of cork and rubber, is now being distributed by the Building Materials Div., Armstrong Cork Co., Lancaster, Pa.

FURNACE The "Ajax-Hultgren" electric salt bath furnace is described in Catalog No. 106, published by the Ajax Electric Co., Frankford Ave. and Allen St., Philadelphia, Pa.

GAS GENERATOR The Roots-Connersville Blower Corp., Connersville, Ind., in an eight-page bulletin No. 100-B13 illustrates a line of inert gas generators for use where a gas free from oxygen is required.

GASKETS Bulletin No. 51A, released by the Goetze Gasket & Packing Co., New Brunswick, N. J., provides specifications of standard gaskets for ring-joint flanges.

GEARMOTORS Leaflet F. 8478, offered by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., outlines the principal features of gearmotors.

GEARS Catalog No. 39, published by the Ohio Gear Co., 1326 E. 179th St., Cleveland, Ohio, contains 136 pages of specifications covering an extensive line of gears, gear reducers, chains and sprockets, V-belts, pulleys, couplings and other accessories.

GEAR REDUCERS A folder issued by Thomas Prosser & Son, 120 Wall St., New York, N. Y., illustrates the "Radicon" line of worm gear speed reducers.

HEAT-TREATING Case - Hardening Service Co., 2281 Scranton Rd., Cleveland, Ohio, has made available folders describing the "CHS" carburizing salts.

HIGH-SPEED STEEL Specifications of seven grades of "Rex" high speed steels are included in a folder issued by the Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.

LATHES Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn., describes the 12-in. Model C Lathe in Circular No. 444.

MAINTENANCE Bulletin No. 1196, published by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., shows many types of motors in various machine tool applications. Entitled "Making Machine Tools Earn Their Way," the booklet discusses features of the "Lo-Maintenance" line of motors.

MATERIALS HANDLING. A 20-page picture book, No. 1630, published by the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., illustrates many industrial applications of overhead conveyors.

MEASURING APPARATUS A 16-page booklet, No. 671, published by the Société Genevoise D'Instruments de Physique, Geneva, Switzerland, describes and illustrates the "SIP" line of universal measuring apparatus.

METAL SPINNING Milwaukee Metal Spinning Co., 1325 S. 43d St., Milwaukee, Wis., has issued a folder illustrating examples of metal spinning.

MILLING ATTACHMENT Features of the "All Angle" full universal, high-speed milling attachment unit are described in a folder issued by Fray-Mershon, Inc., Glendale, Calif.

MONEL Revised Bulletin No. T-5, published by the International Nickel Co., 67 Wall St., New York, N. Y., provides 12 pages of technical information concerning nickel, monel and nickel alloys.

MOTORS Diehl Mfg. Co., Elizabethport, N. J., in its combined motor price list and catalog No. 39, provides 26 pages of information and engineering data on motors, generators, motor-generator sets and various types of ventilating equipment.

NICKEL An index to its bulletins dealing with nickel in the brass foundry has been compiled by the International Nickel Co., 67 Wall St., New York, N. Y.

PACKING A mailing folder now being distributed by J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia, Pa., discusses features of "Tannate" leather packings.

PORTABLE WELDER. An 8-page folder issued by the Progressive Welder Co., 737 Piquette Ave., Detroit, Mich., discusses features of a line of portable hydraulic welding equipment.

PRECISION LATHES Series R 9-in. swing precision lathes are described in Bulletin No. 9 D, issued by the South Bend Lathe Works, 279 E. Madison St., South Bend, Ind.

PRESSES An eight-page illustrated folder issued by the Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y. outlines some of the latest developments in presses, shears and other machines for sheet metal and plate work.

PUMPS Worthington Pump & Machinery Corp., Harrison, N. J., describes a line of high-pressure forged-steel-casing centrifugal pumps in Bulletin No. W-319-B1A.

RESISTORS Instruction leaflet No. 1734-B, issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., contains information on the care of grid type resistors for a.c. and d.c. motors.

ROOFING "Longlife" asphalt roof coating is described in a folder released by the Flexrock Co., 23rd & Manning Sts., Philadelphia, Pa.

SCREWS The William H. Ottemiller Co., York, Pa., has published its 1939 price list of standard cap and set screws. Entitled "Milled Screw Machine Products," it contains 44 pages of specifications and miscellaneous information.

STACK-CUTTING Production of large quantities of intricate shapes from piled steel plates by the oxy-

NEW CATALOG READY

Mr. Hamilton Has Asked Me to Save This Copy for You

★ "The boss and I are trying to get our new precision grinder catalog into the hands of every man who really has use for the world of information it contains. If you are interested in what the boss calls new time and labor-saving set-ups, new technical information, new comparative specification tables and other pertinent information on precision grinding and Dumore Grinders—write me today. Shop men and distributors who have had a preview of the book say it's the most attractive yet most practical catalog in Dumore history. The first edition is already gone, but I'm putting one aside for you from the very next batch that comes from the printers. Use coupon below. I'll give you preference."

DUMORE

PRECISION GRINDERS

MAIL THIS COUPON TODAY!

Miss Jane Dumore,
The Dumore Co., Dept. 139-D, Racine, Wis.
It sounds like you folks "have something," in that new precision grinder catalog of yours. Send my copy by return mail.

Firm Name_____
Individual_____ Title_____
Address_____
City_____ State_____
Our Industrial Distributor is_____

acetylene cutting process is described in an eight-page booklet, "Stack Cutting Speeds the Production of Identical Parts," issued by the Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

STAINESS STEEL A 72-page stock list published by the Chicago Steel Service Co., 3912 S. Ashland Ave., Chicago, Ill., contains detailed information concerning an extensive line of stainless steel products. Mills represented are the Republic Steel Corp., Globe Stainless Tube Co., Maurath, Inc., and Rustless Iron & Steel Corp.

STANDARDS The 1939 edition of the index to the American Society for Testing Materials Standards and Tentative Standards contain 140 pages and includes a list of the A.S.T.M. serial designations. Copies may be obtained from the headquarters of the society, 260 S. Broad St., Philadelphia, Pa.

STEEL Allegheny Ludlum Steel Corp., Pittsburgh, Pa., has begun publication of "Steel Horizons," a generously illustrated magazine of large format. To be issued six times a year, the publication will include news from fabricators as well as indicating the services provided by Allegheny Ludlum.

STEEL CASTINGS Characteristics of stainless steel castings are discussed in "Smith Stainless Steel Castings," an illustrated folder issued by the Stainless Steel Div., Smith Steel Foundry Co., 1320 S. First St., Milwaukee, Wis.

STELLITE A 16-page bulletin published by the Haynes Stellite Co., Kokomo, Ind., comprises tables of physical, mechanical and chemical properties of Haynes Stellite, Haystellite, Hascrome, and Hastelloy.

SWITCHES Descriptive data sheet No. 15-100, issued by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., illustrates features of the new Type SM heavy-duty master switches for mill and crane controllers.

TAPPING "Nevers," a booklet covering tapping practices to be avoided, has been published by John Bath & Co., 18 Grafton St., Worcester, Mass.

THERMOMETER Bulletin No. 4201, released by Wheelco Instruments Co., 1929 S. Halstead St., Chicago, Ill., describes the Series 4200 industrial indicating control thermometer.

THREAD MILLER A fully motorized hob thread milling machine is described in a pamphlet released by James Coulter Machine Co., Bridgeport, Conn.

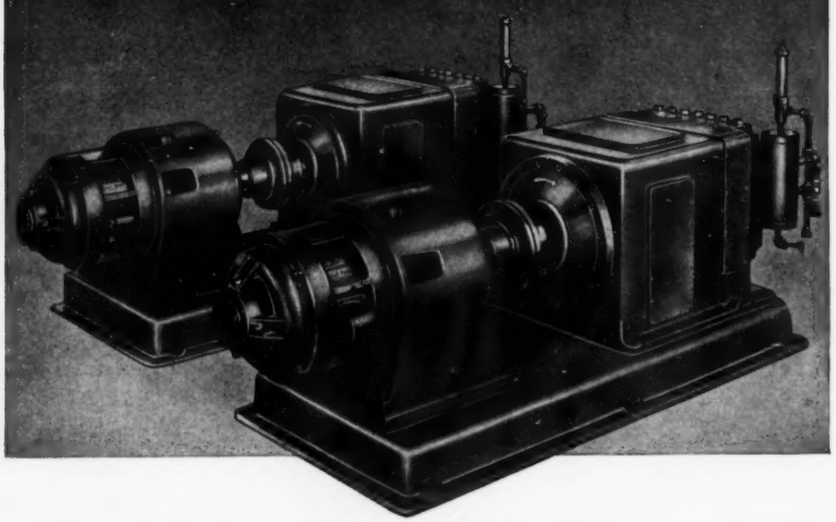
TIME RECORDERS Bulletin No. 139, published by the Esterline-Angus Co., Indianapolis, Ind., contains 12 pages of specifications covering an extensive line of time recorders, along with information concerning their selection, application and use.

TOOLS George Scherr Co., 124 Lafayette St., New York, N. Y., has published a general catalog showing an extensive line of machine tools, hand tools, instruments and accessory equipment.

TRUCKS Crescent Truck Co., Lebanon, Pa., has published a 46-page illustrated catalog describing an extensive line of electric industrial trucks and tractors.

TURRET LATHES Bulletin No. 1073, published by the Gisholt Machine Co., 1201 Washington East Ave., Madison, Wis., provides specifica-

Smooth . . .
HYDRAULIC POWER



Stediflo Hydraulic Pressure Pumps utilize a greatly improved design that results in more efficient operation and more compact installations. A circular arrangement of plungers, actuated by a swash plate, insures high efficiency and **greatly reduced pulsation.**

Made in capacities from 1500 lbs. per sq. in., and upward, for oil, water or any liquid, they can be easily equipped with special bodies and plungers for low pressures or corrosive liquids.

Take advantage of our expert service to get hydraulic pumps and presses "engineered to your jobs" for greatest economy and efficiency.

W-S HYDRAULIC

Hydraulic Presses
For Every Purpose
High Pressure Pumps
Accumulators
Hydro-Pneumatic
Weighted Types
Operating Valves
Leather Packings
Forged Steel Fittings

THE WATSON-STILLMAN CO.
107 Aldene Rd., ROSELLE, N.J.

tions, descriptions and illustrations covering the 1L, 2L and 3L lines of high production turret lathes.

VALVES A standard line of blast gate valves for the control of air, gas and liquids is described in Bulletin No. 8A, issued by the R-S Products Corp., Philadelphia, Pa.

VISE A folder released by Fray-Mershon, Inc., Glendale, Calif., describes features of the "All-Angle" portable toolmakers' vise.

VOLTAGE BOOSTERS Catalog Section No. 47-225, announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., gives information on the Type BR two-step feeder voltage boosters. Catalog Section No. 47–230 describes the Type LR four-step feeder voltage booster-regulators.

WASHFOUNTAINS Enameled iron and stainless steel semi-circular washfountains are described in a folder issued by the Bradley Washfountain Co., N. 22nd & W. Michigan Sts., Milwaukee, Wis.

WELDING The "Well-O-Trol," an a.c. welding contactor without timing, is described in descriptive data sheet No. 18–345, released by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

NEW BOOKS

Mechanism—Fourth Edition. By Robert McArdle Keown, B.S., engineer, Industrial Commission of Wisconsin. Revised and rewritten by Virgil Moring Faires, M.S., M.E., professor of mechanical engineering, Agricultural and Mechanical College of Texas. 282 *pages,* 6x9 *in. Cloth-board binding. Indexed and illustrated. Published by McGraw-Hill Book Co.,* 330 *W.* 42*nd St., New York, N. Y. Price* $2.75.

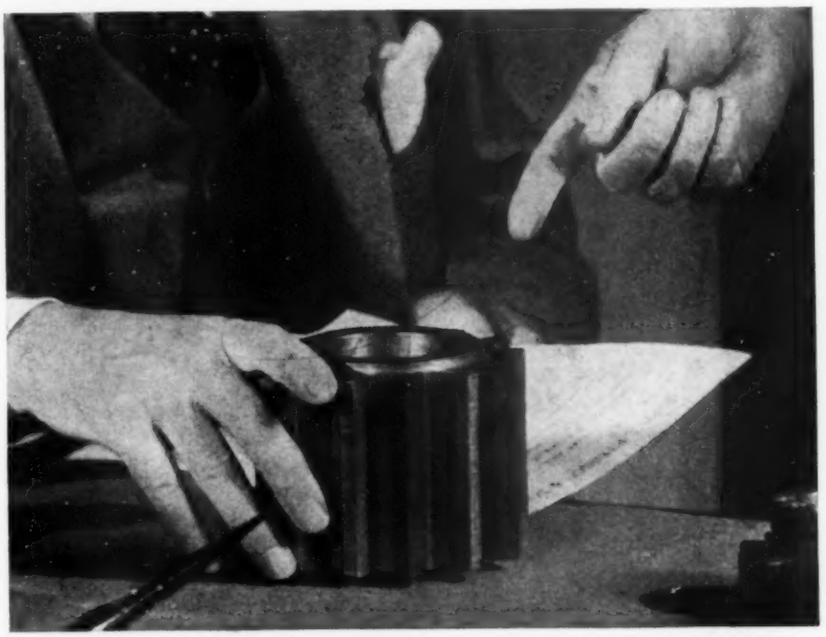
This volume, originally published in 1912, has been completely rewritten in order to keep the book abreast of modern developments and in order to improve the presentation of the subject matter. The general plan of the previous edition has been followed, wherein the simplest phases of the subject are taken up as soon as the basic plan of organization permits. Since students usually find the study of friction wheels comparatively easy, the material on friction drives has been moved forward to the second chapter, in which the equations of motion are presented. Also, there has been some regrouping of the discussion of centrose and velocities. New material on the proportions of gear teeth has been added to the chapters on gearing. Some of the line drawings have been remade in the interests of clarity, and for the same reason, several photographic illustrations have been substituted for line drawings previously used. Additional material includes a short chapter on accelerations, discussions of non-circular rolling surfaces, block-and-tackle devices, the Gleason straight bevel gear tooth, the Geneva mechanism and the universal joint.

SEEN and HEARD

JOHN R. GODFREY

Can We Lubricate the Cutting Tool?

Continuing the metal-cutting subject, there are a number of points to consider about coolants or lubricants. Dave Wallace, for example, tells us of the tremendous pressure and high heat developed in either cutting or grinding. Can the oil or water get



Uniform Results..Lower Costs with Ryerson Certified Alloys

You can reduce failures—eliminate spoilage and get better results in less time with Ryerson Certified Alloy Steels. They are from selected heats of steel that meet an ideal specification—a "specification within a specification"—that assures uniform response to heat treatment.

All Ryerson Certified Alloys are analyzed and tested in advance. Special data sheets showing exact chemical analysis, grain size, cleanliness rating, and results of actual heat treatment tests, are prepared and sent with every shipment. You know exactly what you are getting. Your heat treater does not have to test. He takes no chances. Spoilage is eliminated and sound dependable jobs of high accuracy and uniformity are secured.

Ryerson has large and complete stocks of these selected identified alloy steels. They cost no more and quick shipment is assured.

Ryerson Certified Steels also include carbon, tool and stainless steels that meet definite quality standards. They offer many advantages to steel users. Let us tell you the complete story. Write for booklet.

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

RYERSON CERTIFIED STEELS

RYERSON *Certified* STEELS

between the top of the tool and the work to act as a lubricant? Can it do anything more than help carry away the heat?

A. L. De Leeuw tells of the advantages of polishing the tool surface to help the chip slide over it, and also of the peculiar effect of different lubricants or coolants. In one case a change in coolant caused decided variations in the sizes of parts from an automatic. Changing back to the old coolant, and without touching the tools, gave product of uniform diameters. It is understandable that coolants give different diameters, as we use heavy oil to make a tap cut large. But why the same coolant should give a variety of sizes remains among the mysteries that future research will have to answer.

Steam Automobiles Again

Sometimes a man will devise a most ingenious and useful apparatus while his next idea may put him in the "nut" class. One of these cases is the gent who (probably accidently) discovered that drops of water striking an electrical heating element, flashes into steam. So, without figuring current cost, size of element, or anything else apparently, he rushes into print as the inventor of instantaneous steam generation, and predicts its use in making the steam engine the ideal power for automobiles.

As one who has driven steam cars and knows their advantages, I'd be glad to have another—if someone else will supply steam. But the notion of lugging around a large storage battery to use in making steam and charging these at service stations as the inventor suggests, somehow does not have a strong appeal. It is hard to understand how anyone can get enthused, or even mildly interested in such a scheme. Which bears out the idea that inventors may be a breed all to themselves.

FIND OUT FOR YOURSELF WHY METAL MEN VOTED

Houghton, 2 to 1

IN CUTTING OIL PREFERENCE!

Yes! . . . a two-to-one favorite over the second choice. And further, Houghton was given three times as many "firsts" as any other supplier of cutting coolants. These figures are the result of a national, independent survey . . . and the reasons for this leadership can be demonstrated positively in your plant.

Users of Houghton's Cutting Fluids tell us that they are getting finer finish, higher surface speed, longer tool life, increased production and less cost per unit produced. *You* can do the same. Write for illustrated leaflets describing CUT-MAX Straight Oils and Bases, and the "60" Series of Soluble Cutting Oils . . . or send for the Houghton Man.

CUT-MAX

An all-inclusive series of straight cutting oils and bases, embodying the latest developments in sulphurized and E. P. treated products for *every* cutting need.

CUT-MAX Base No. 7, containing an 18% minimum of superactive sulphur—combined in a colloidal state—is absolutely unequalled in refrigerating and cutting efficiency. We will prove this in your plant.

E. F. HOUGHTON & CO.
240 W. SOMERSET STREET
Chicago - PHILADELPHIA - Detroit

THE HOUGHTON LINE
OF STRAIGHT AND SOLUBLE CUTTING OILS

Poorly Equipped Railroad Shops

FRANK C. HUDSON

A recent visit to some of the railroad shops in the Southwest revealed the same wide discrepancy as to equipment and methods as in years gone by. The high sounding names of the railroad was not reflected in either buildings or shop equipment. The wonder is that men can and do handle repairs on heavy, modern locomotives with such inadequate equipment. That locomotives can be kept in operation under such difficulties speaks volumes for both the shop executives and the men who do the work.

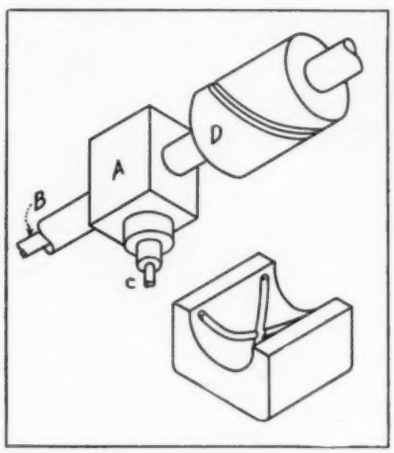
Few shops today finish piston rods without a grinding machine. The roundness and uniformity of diameter are essential factors in preventing steam leakage and in keeping down the cost of metallic packing. Yet one shop was still finishing by rolling, a practice that most roads abandoned long ago. The only modern equipment in some shops was an arc welder with which worn metal can be replaced on pistons, driving boxes, hub and wear liners, and many other parts. It is difficult to realize the part now played by our modern "putting-on" tool.

Heating tires for shrinking them into place was done in one place by stacking old railroad ties around a set of tires and setting them on fire. When the ties have burned away the tires are expanded enough to be slipped over the wheel centers, with a "shrink" of from $\frac{1}{16}$ to $\frac{3}{32}$ in. for the average driving wheel. Tires are removed by heating with a gas ring, as is customary in most shops.

Parts of the locomotive that are too large to go into a lye tank, are cleaned with a sand blast, outside the shop.

Wear plates on driving boxes and hub liners in driving wheels, are handled in various ways. Many cast the wear plate into a dovetailed and drilled recess in the side of the driving box. The metal in the drilled holes acts as a dowel and prevents turning. Some put no hub liners in the driving wheels until after they wear, when they are recessed to receive the liner. These liners vary from babbitt cast into the hub to steel plates tacked in position by welding, with numerous variations in between.

Steel boiler plate, steel of better wearing quality, cast iron and bronze are all used as liners on different railroads. Some fasten them with dowels and cone-head cap screws while others weld them in place and



a few let them turn freely, as do floating bushings in the connecting rods.

Brass is now used quite extensively for crosshead shoes, replacing cast iron and steel. A common practice is to use the brass shoe as a bearing on the crosshead guides until the wear is about $\frac{1}{16}$ in. on a side, or $\frac{1}{8}$ in. total. The shoe is then babbitted to bring it back to size, this being repeated as often as necessary. Brass makes such a good base for babbitt that it is easy to get a thin lining that will hold and wear well under almost all service conditions.

Practically all railroad shops report piston-rod breakage through the taper keyway by which the key holds the rod in the crosshead in a taper fit of 1 in. in 20 in. In some cases the crosshead suffers when old piston rods have to be forced out. It is difficult to see just why the taper fit and draw key have been used as long as they have. Split crossheads have been clamped on the piston rods at times for the past 50 years, but the key seems hard to displace. It is to be hoped that the Timken design may succeed in helping us out of a rut that nearly all realize to be costly and almost inexcusable.

Lubrication of locomotive bearings continues to be a problem on most roads. Many are beginning to doubt the wisdom or economy of depending on hard grease that requires the bearing to warm up before it can get to the bearing. Force feed lubrication is coming into favor on the more progressive roads, with satisfactory results in reducing delays caused by hot bearings.

One shop has rigged up an old type horizontal boring machine for cutting grease grooves in crown brasses, something as shown herewith. The case *A* contains bevel gearing through which the shaft *B* driven from the machine spindle, drives the two lipped routing cutter *C*. The cam drum *D* guides the cutter head so that it will rout out the grease grooves shown in the box below. Any desired pattern of grooves can be had by making a cam to suit. This is a case where an old machine that has outlived its use-

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fulness for boring work, serves well for this special job.

Other shops in this section have better equipment, both buildings and machinery, than those referred to here, and will be mentioned later.

Trading Estates

So popular have the trading estate projects become in Great Britain that it is likely their use will be extended. "Trading estate" is the name given to an industrial community which receives some sort of government sponsorship to stimulate new businesses and thus provide employment.

Under the new Industries Development Act, passed in Northern Ireland in 1937, offers of a free site and exemption from local tax rates has resulted in the planning of enterprises for some 7,000 people. Under another act passed later in the same year, extending the facilities offered, 63 applications have been received and definite offers of assistance made in 20 cases. While Northern Ireland has its own parliament and government, it is an integral part of the United Kingdom, and there is no tariff or other barrier between the province and Great Britain.

A fourth factory, according to *Industrial Britain,* is to be built on the trading estate at Pallion, Sunderland. It will employ about 50 work people. At present there are two factories in operation on the estate, an oxygen plant and a clothing factory, and a third, an acetylene plant, is nearly completed.

The threat of war caused a rush of applications and inquiries of factory sites on the government aided trading estate at Treforest, South Wales. Over 50 firms have now become tenants of the Estate.

Of the 27 factories occupied, 21 are in production, while 20 others now being built include four factories with an area of 12,000 sq. ft. each. According to an official: "Immunity from air raids is one of the chief reasons for the satisfactory new demand for sites at Treforest. Although nearer London than any other government trading estate, it is well off the track of potential air attackers."

Four of the new plants were completed in September, and there are now 682 persons that work in the various factories at Treforest, while some 562 men are engaged in further developments. Total number in employment on South Wales trading estates enterprises to date is 2,061.

The number of tenants on the Team Valley trading estate and other properties administered by North-East Trading Estates, Ltd., was 119 at the beginning of November.

Among recent tenants are: Darlington Engineering Company, manufacturers of gears and machine parts; Consolidated Pneumatic Tool Company, which has set up a maintenance service depot for the northeast coast area, Double Seal Ring Company, manufacturers of piston rings in the United States and Lauson Beck, manufacturers of cartridge-type fuses of new design.

A contract has been let by the Tyne Improvement Commission for the clearing of a direct site at Jarrow to make it suitable for new industries. The site is on the Mercantile Dry Dock Company's estate at Jarrow, and over 85,000 cu. yds. of earth are to be removed.

The West Hartlepool and Hartlepool municipalities have ear-marked a site of 45 acres for the purpose of a small trading estate. Industrial enterprises thereon will be eligible for assistance from the Commissioner for the Special Areas.

A toy-making factory has been

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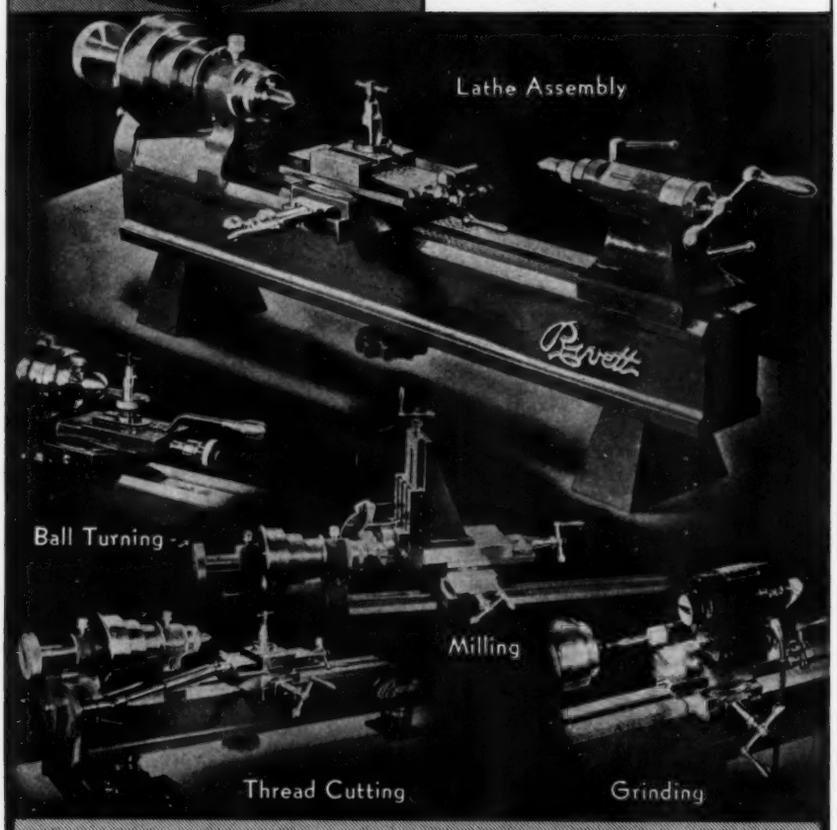

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opened at Hartlepool providing initial employment for 100 persons.

In two of the small trading estates recently established in the Scottish Special Area, at Carfin and Larkhall, nine blocks of building are to be erected, six at the former and three at the latter, by Industrial Estates, Ltd.

Straight "Not Go" Plugs Check Thread Depth

BY G. J. BELBES

Practically every thread element in tapped holes can be checked with standard thread gages. Such gages, however, do not show up tapped holes in which the depth of thread is not sufficient, so long as the threads are not flattened or torn beyond the pitch line.

It is contended by some that since the pitch diameter is the effective working line no failure will occur so long as the thread is full up to or slightly above the addendum. That this is fallacious is readily seen if a condition is assumed in which both the screw and the nut have a 50 per cent depth of thread; such a condition obviously would result in complete failure of the joint.

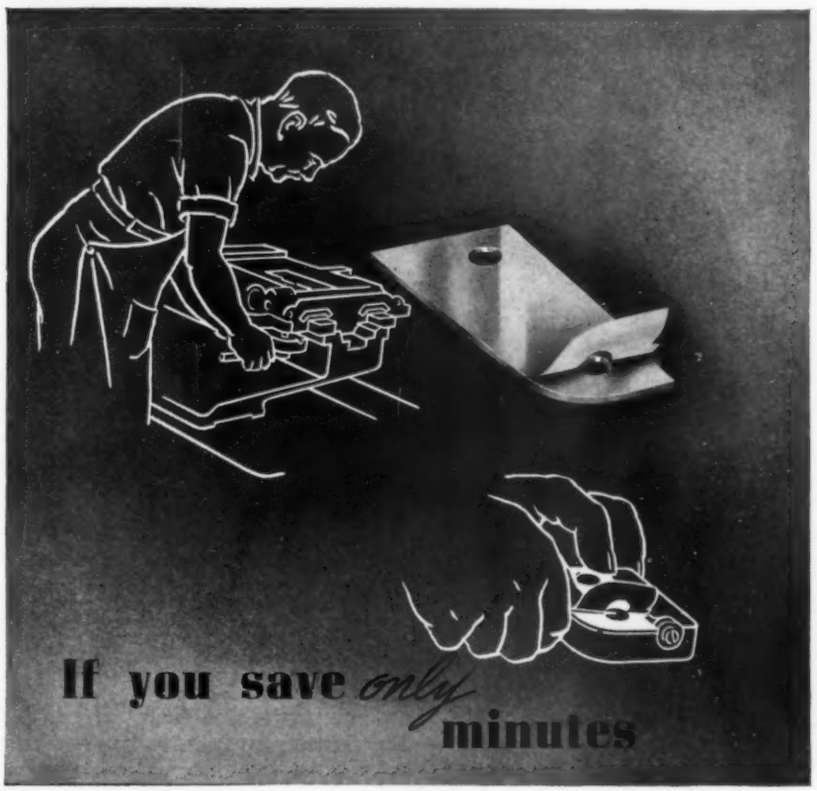
This extreme condition can be averted by maintaining the screw threads close to the standard dimensions while permitting the tapped hole to vary widely from the basic size. While it is often safe to accept goods having such a combination, this should not be substituted for a sound assembly. The holding qualities of a threaded joint depend upon the cross-section area, thread contact area and the form of thread in both members. Departures from standard in any of these basic factors will result in decreased effectiveness of the joint.

Of course, closely fitted, full-depth threads can be obtained only at considerable expense. However, this condition should be approached as closely as is economical for the particular product. Having determined the thread depth required to satisfy a given set of conditions, it will facilitate inspection operations, reduce the cost of inspection, and quickly indicate defective tapping if a set of "not go" plug gages are provided for the range of tapped holes to be inspected.

Such "not go" gages should be used in addition to the regular threaded plug gages for checking tapped holes and can be made up from drill rod for any desired percentage of thread depth. The proposed "flat-stripped" plug sizes can be computed readily by multiplying the double depth of the full thread by the per cent of thread depth required, and subtracting the result from the outside diameter of the tap. The result of these calculations will yield the limiting diameter of the "flat-stripped" plug.

For sharp 60 deg. V threads, the double depth of thread is 1.732 P, where P is the pitch of the thread. This value is 1.299 P for American Standard threads. When checking tapped holes with these plugs, the part should be rejected if the plug enters the hole.

High-speed helical gears have come into general use for marine and other large unit installations. The British Navy alone has over ten million horsepower installed. A. Peterson, one of the engineers of the DeLaval Steam turbine Company, has devised a method for specifying tooth pressures for high-speed, helical gears that is helpful to designers of gears of this type.



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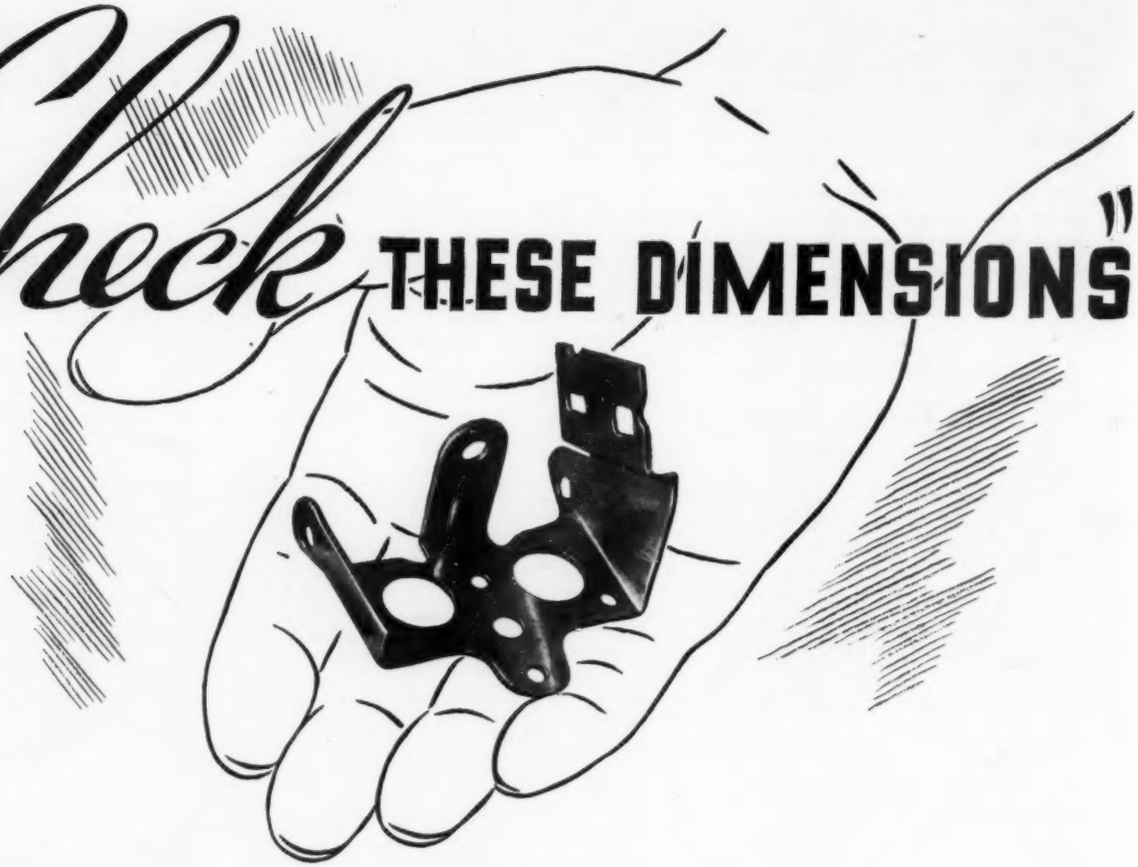

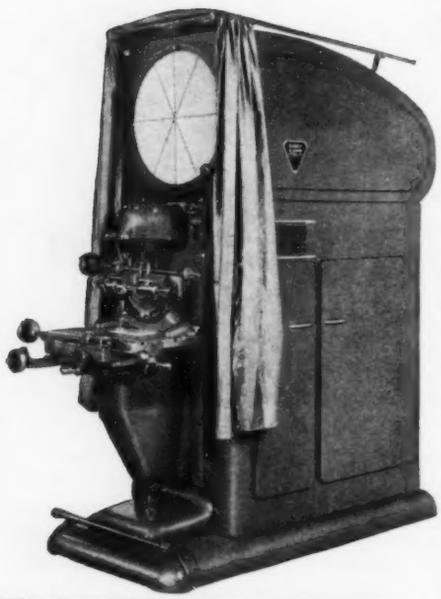

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